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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N76-23152*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 68)
Mar. 1976 99 p
(NASA-SP-7037(68)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 339 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1976. Author

N76-23153# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THOUGHTS ON THE FUTURE TASKS OF THE EUROPEAN AVIATION INDUSTRY IN THE REALM OF CIVIL AVIATION
Claudius Dornier, Jr. 21 Nov. 1975 22 p Transl. into ENGLISH from Der Flieger (West Germany), v. 55, no. 6, Jun. 1975 p 221-226
(AD-A018470; FTD-ID(RS)I-2214-75) Avail: NTIS CSCL 01/2

A report is made on the past deficiencies in the European air transportation industry, and on some possibilities for future developments. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-23154 Virginia Polytechnic Inst. and State Univ., Blacksburg.
FLUTTER OF LAMINATED PLATES IN SUPERSONIC FLOW Ph.D. Thesis
James Wayne Sawyer 1975 132 p
Avail: Univ. Microfilms Order No. 76-11272

A procedure was developed for solving flutter problems of simply supported laminated plates using linear small deflection theory. The plate construction may be arbitrary as long as it satisfies the assumptions of linear small deflection theory. For such plates, the bending and extensional governing equations are coupled and have cross-stiffness terms which do not appear in classical plate theory. The coupling and cross-stiffness terms occur as a result of the lamina principal directions (fibers) not coinciding with the neutral surface of the plate. The extended Galerkin method is used to obtain approximate solutions to the governing equations where the aerodynamic pressure loading used in the analysis is that given by linear piston theory with flow at arbitrary cross-flow angles. Dissert. Abstr.

N76-23155 Texas Univ., Arlington.
WING LOADING THEORY SATISFYING ALL BOUNDARY POINTS Ph.D. Thesis
John DeYoung 1975 180 p
Avail: Univ. Microfilms Order No. 76-11674

Subsonic wing loading theories are developed to satisfy boundary conditions of the wing analytically at all points. This approach is applied to lifting line theory and to lattice vortex theory. A load line theory is developed for which boundary conditions are satisfied at all points spanwise along the load line. With the introduction of an induced angle parameter, this load line theory has the accuracy of lifting surface theory but the analytical simplicity of lifting line theory. The load line theory provides a means for the analytical determination of ideal tapered wings. Swept wing parameters are developed which make load line theory applicable to arbitrary planform. Because load line theory is quasi two-dimensional it is ideally suited for the more complex type of loading solutions such as taking into account interference effects of fuselage, jets, multiplanes. Dissert. Abstr.

N76-23156 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF INCOMPRESSIBLE LAMINAR FLOW ABOUT ARBITRARY BODIES IN BODY FITTED CURVILINEAR COORDINATES Ph.D. Thesis
James Kirk Hodge 1975 202 p
Avail: Univ. Microfilms Order No. 76-11795

Numerical solutions for incompressible laminar flow about arbitrary bodies in multi-connected regions are obtained. A finite difference method for solving the inviscid stream function equation for two-dimensional and axisymmetric flow is utilized, an approximate numerical method of solving the axisymmetric boundary layer equations with transverse curvature is developed, and a finite difference method of solving the two-dimensional Navier-Stokes equations is developed for two-dimensional regions with and without a symmetry line. Dissert. Abstr.

N76-23157 Tennessee Univ., Knoxville.
ATMOSPHERIC FLOW OVER TWO-DIMENSIONAL BLUFF SURFACE OBSTRUCTIONS Ph.D. Thesis
Juergen Bitte 1975 229 p
Avail: Univ. Microfilms Order No. 76-11032

The phenomenon of atmospheric flow over a two-dimensional surface obstruction such as a building is analyzed by three methods: (1) an inviscid free streamline approach, (2) a turbulent boundary layer approach using an eddy viscosity turbulence model and a horizontal pressure gradient determined by the inviscid model and (3) an approach using the full Navier-Stokes equations with three turbulence models, i.e., an eddy viscosity model, a turbulence kinetic energy model and a two-equation model with an additional transport equation for the turbulence length scale. A comparison of the performance of the different turbulence models is given, indicating that only the two-equation model adequately accounts for the convective character of turbulence. Dissert. Abstr.

N76-23158 Tennessee Univ., Knoxville.
THE EFFECTS OF PERIODIC FREE STREAM DISTURBANCES ON THE FLAT PLATE BOUNDARY LAYER

Ph.D. Thesis
John Addison Benek 1975 165 p
Avail: Univ. Microfilms Order No. 76-11031

The growth of perturbations to the boundary layer induced by a periodic wave disturbance in the far field is examined. The equations of motion for the perturbation are reduced to a nonhomogeneous Orr-Sommerfeld equation which is solved in terms of the eigenfunctions of the homogeneous equation. Computations of the root mean square fluctuating velocity at constant fraction of the boundary layer thickness indicate higher amplitudes at lower Reynolds numbers than that expected without the presence of the free stream disturbance. It is suggested that the presence of the disturbance in the free stream may induce a transition to turbulence at a lower value of Reynolds number than the unforced case. Dissert. Abstr.

N76-23159*# McDonnell-Douglas Corp., Long Beach, Calif.
CORRECTION FACTORY TECHNIQUES FOR IMPROVING AERODYNAMIC PREDICTION METHODS Final Report
Joseph P. Giesing, Terez P. Kalman, and William P. Rodden May 1976 288 p refs
(Contract NAS1-13835)
(NASA-CR-144967) Avail: NTIS HC $9.25 CSCL 01A

A method for correcting discrete element lifting surface theory to reflect given experimental data is presented. Theoretical pressures are modified such that imposed constraints are satisfied while minimizing the changes to the pressures. Several types of correction procedures are presented and correlated; (1) scaling of pressures; (2) scaling of downwash values; and (3) addition of an increment to the downwash that is proportioned to pressure. Some special features are included in these methods and they include: (1) consideration of experimental data from multiple deflection modes, (2) limitation of the amplitudes of the correction factors, and (3) the use of correction factor mode shapes. These methods are correlated for cases involving all three Mach Number ranges using a FORTRAN IV computer program. Subsonically, a wing with an oscillating partial span control surface and a wing with a leading edge droop are presented. Transonically a two-dimensional airfoil with an oscillating flap is considered. Supersonically an arrow wing with and without camber is analyzed. In addition to correction factor methods an investigation is presented dealing with a new simplified transonic modification of the two-dimensional subsonic lifting surface theory. Correlations are presented for an airfoil with an oscillating flap. Author

N76-23160*# Polytechnic Inst. of New York. Aerodynamics Labs.
CALCULATION OF THE THREE-DIMENSION, SUPERSONIC, INVISCID, STEADY FLOW PAST AN ARROW-WINGED AIRFRAME, PART 1 Interim Report
Gino Moretti May 1976 38 p refs
(Grant NsG-1248)
(NASA-CR-147230; POLY-AE/AM-76-8-Pt-1) Avail: NTIS HC $4.00 CSCL 01A

A detailed description of the procedure used to compute three dimensional, supersonic, inviscid, steady flows past airframes is given. No limitations are imposed on the geometry of the airplane. Suitable computational grids are generated by automatic conformal mappings. The equations of motion, with pressure, entropy, and velocity direction as basic unknowns, are written and discretized in the computational space. Special rules to approximate derivatives are given. Boundary points are treated by a modified method of characteristics. Author

N76-23161*# Old Dominion Univ., Norfolk, Va. School of Engineering.
TRANSIENT RESPONSE CHARACTERISTICS OF TEST CHAMBER MACH NUMBER Progress Report, Nov. 1975 - Apr. 1976
Ping Tcheng May 1976 13 p
(Grant NsG-1079)
(NASA-CR-147919; TR-76-T9) Avail: NTIS HC $3.50 CSCL 01A

The transient dynamic characteristics of a test chamber Mach number was established for a disturbance initiated in the test chamber. An approximate linear expression was given, showing that the change in the Mach number is linearly proportional to the algebraic sum of the static pressure change in the test chamber and the stagnation pressure change. The static pressure change is the dominating factor. The two pressure changes were also calculated for small Mach number variations, and these results were applied to instrumentation requirements. Y.J.A.

N76-23162*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SUBMERGED SINGULARITY METHOD FOR CALCULATING POTENTIAL FLOW VELOCITIES AT ARBITRARY NEAR-FIELD POINTS
Brian Maskew Mar. 1976 45 p refs
(NASA-TM-X-73115; A-6498) Avail: NTIS HC $4.00 CSCL 01A

A discrete singularity method has been developed for calculating the potential flow around two-dimensional airfoils. The objective was to calculate velocities at any arbitrary point in the flow field, including points that approach the airfoil surface. That objective was achieved and is demonstrated here on a Joukowski airfoil. The method used combined vortices and sources "submerged" a small distance below the airfoil surface and incorporated a near-field subvortex technique developed earlier. When a velocity calculation point approached the airfoil surface, the number of discrete singularities effectively increased (but only locally) to keep the point just outside the error region of the submerged singularity discretization. The method could be extended to three dimensions, and should improve nonlinear methods, which calculate interference effects between multiple wings, and which include the effects of force-free trailing vortex sheets. The capability demonstrated here would extend the scope of such calculations to allow the close approach of wings and vortex sheets (or vortices). Author

N76-23163# Advisory Group for Aerospace Research and Development, Paris (France).
A COMPARISON OF METHODS USED IN INTERFERING LIFTING SURFACE THEORY
W. P. Rodden Feb. 1976 68 p refs
(AGARD-R-643-Suppl; ISBN-92-835-1210-3) Avail: NTIS HC $4.50

Flow field prediction methods for interfering lifting surfaces cover subsonic and supersonic aerodynamic loads. For individual titles, see N76-23164 through N76-23168.

N76-23164 Advisory Group for Aerospace Research and Development, Paris (France).
INTERFERENCE AND NONPLANAR LIFTING SURFACE THEORIES
William P. Rodden (La Canada, Calif.) *In its* A Comparison of Methods Used in Interfering Lifting Surface Theory Feb. 1976 p 2-5 (For availability see N76-23163 14-02)

The latest prediction methods for unsteady aerodynamic forces acting on interfering lift configurations are discussed. The collocation method and finite element analysis are applied to subsonic flows. Supersonic procedures include the box integration method, the box collocation method, and the collocation method. G.G.

N76-23165 Advisory Group for Aerospace Research and Development, Paris (France).
THE NONPLANAR KERNEL FUNCTIONS
William P. Rodden (La Canada, Calif.) *In its* A Comparison of Methods Used in Interfering Lifting Surface Theory Feb. 1976 p 5-9 (For availability see N76-23163 14-02)

Nonplanar acceleration potential aspects for the kernels of the lifting surface integral equation are developed for the subsonic case. A velocity potential kernel is applied to supersonic flow analysis. G.G.

N76-23166 Advisory Group for Aerospace Research and Development, Paris (France).
SUBSONIC METHODS
William P. Rodden (La Canada, Calif.) *In its* A Comparison of Methods Used in Interfering Lifting Surface Theory Feb. 1976 p 9-12 (For availability see N76-23163 14-02)

Kernel function and Doublet-Lattice Method (DLM) applications for solving subsonic lifting surface problems are outlined. The first method uses chordwise collocation points to evaluate

downwash, and the second method applies finite element analysis to obtain downwash expressions. G.G.

N76-23167 Advisory Group for Aerospace Research and Development, Paris (France).
SUPERSONIC METHODS
William P. Rodden (La Canada, Calif.) *In its* A Comparison of Methods Used in Interfering Lifting Surface Theory Feb. 1976 p 12-13 (For availability see N76-23163 14-02)

Refined Mach box integration procedures are reported for numerical analysis of supersonic lifting surface interference effects. G.G.

N76-23168 Advisory Group for Aerospace Research and Development, Paris (France).
PREFACE TO FIGURES AND TABLES
William P. Rodden (La Canada, Calif.) *In its* A Comparison of Methods Used in Interfering Lifting Surface Theory Feb. 1976 p 13-25 refs (For availability see N76-23163 14-02)

Data are compared from three different solutions of the lifting surface problem. The first task is the determination of the flow field, i.e., the velocity components in the field surrounding the oscillating wing. The second task is the calculation of the interference loading, i.e., lift and moment coefficients, on two surfaces induced by the motion of the forward surface. The third task is the calculation of the generalized forces resulting from the motions of the various components of an interfering wing-horizontal tail-fin configuration. The computation of each of these derived quantities from the solution of the basic lifting surface problem is indicated below. Author

N76-23169*# George Washington Univ., Washington, D.C.
COMPUTATIONAL ASPECTS OF REAL-TIME SIMULATION OF ROTARY-WING AIRCRAFT M.S. Thesis
Jacob Albert Houck May 1976 125 p refs Sponsored by NASA
(NASA-CR-147932) Avail: NTIS HC $5.50 CSCL 01A

A study was conducted to determine the effects of degrading a rotating blade element rotor mathematical model suitable for real-time simulation of rotorcraft. Three methods of degradation were studied, reduction of number of blades, reduction of number of blade segments, and increasing the integration interval, which has the corresponding effect of increasing blade azimuthal advance angle. The three degradation methods were studied through static trim comparisons, total rotor force and moment comparisons, single blade force and moment comparisons over one complete revolution, and total vehicle dynamic response comparisons. Recommendations are made concerning model degradation which should serve as a guide for future users of this mathematical model, and in general, they are in order of minimum impact on model validity: (1) reduction of number of blade segments; (2) reduction of number of blades; and (3) increase of integration interval and azimuthal advance angle. Extreme limits are specified beyond which a different rotor mathematical model should be used. Author

N76-23170*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF REYNOLDS NUMBER ON THE AERODYNAMIC STABILITY AND CONTROL CHARACTERISTICS OF A 55 DEG CLIPPED-DELTA-WING ORBITER CONFIGURATION AT SUPERSONIC MACH NUMBERS
A. B. Blair, Jr. Washington May 1976 97 p refs
(NASA-TM-X-3376; L-10752) Avail: NTIS HC $5.00 CSCL 01A

A wind-tunnel investigation has been conducted at Mach numbers from 1.60 to 4.63 for Reynolds numbers varying from approximately 0.8 million to 10.0 million (based on body length) to determine the Reynolds number effects on the static longitudinal and lateral aerodynamic stability and control characteristics of two scale models of the Grumman H-33 space shuttle orbiter. The results indicate that for the Reynolds number range investigated, there are no Reynolds number effects on the longitudinal or lateral aerodynamic characteristics of either model with zero control deflections and only negligible effects with control deflections. The roll control is constant for both models with the possible exception of a slight increase with increases in Reynolds number up to 2.0 million at the lower Mach numbers. This very small Reynolds number effect is much more apparent for the smaller model and disappears with increasing Mach and Reynolds numbers. Author

N76-23171*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF EFFECT ON ISOLATED BOATTAIL DRAG OF VARYING REYNOLDS NUMBERS UP TO 130,000,000
David E. Reubush and Lawrence E. Putnam Washington May 1976 85 p refs HC $5.00
(NASA-TN-D-8210; L-10521) Avail: NTIS CSCL 01A

An investigation was conducted to determine whether large Reynolds number effects occur on isolated boattails, including an analytical study and tests in a 1/3-meter transonic cryogenic tunnel. This investigation was conducted at an angle of attack of 0 deg at Mach numbers from 0.6 to 0.9 for Reynolds numbers up to 130 million. Results indicate that as the Reynolds number was increased, the static pressure coefficients in the expansion region of the boattail became more negative whereas those in the recompression region became more positive. These two trends were compensating and, as a result, there was only a small effect (if any) of Reynolds numbers on boattail pressure drag. Author

N76-23172# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT OF THE TRAILING VORTEX SYSTEMS OF LARGE TRANSPORT AIRCRAFT, USING TOWER FLY-BY AND FLOW VISUALIZATION (SUMMARY, COMPARISON AND APPLICATION) Final Report, Apr. 1971 - Nov. 1973
Leo J. Garodz, David M. Lawrence, and Nelson J. Miller Jan. 1976 271 p refs
(AD-A021305/8; FAA-NA-75-3; FAA-RD-75-127) Avail: NTIS HC $9.00 CSCL 20/4

Full-scale flight test investigations were made of the characteristics, persistence and movement of the trailing vortices generated by propeller and jet transport aircraft, using tower fly-by and vortex flow visualization. The results are summarized and comparisons made of the vortices of the Douglas DC10, DC9, and DC7; Boeing 747, 727, and 707; Lockheed C5A, C141, and L1011; and the Convair 880 aircraft. Vortex mathematical models and decay mechanisms are discussed. Their effects (upset potential) on encountering aircraft were investigated for possible air traffic control application. Author

N76-23173*# Kanner (Leo) Associates, Redwood City, Calif.
COMPARISON OF THEORETICAL AND EXPERIMENTAL PROFILE DRAGS
R. Eppler Washington NASA Apr. 1976 12 p refs Transl. into ENGLISH from Schweizer Aero-Rev. (Switzerland), v. 38, no. 10, Oct. 1963 p 593-595
(Contract NASw-2790)
(NASA-TT-F-16981) Avail: NTIS HC $3.50 CSCL 01A

Experimental values of profile drags were compared with calculated values, the latter obtained from potential theory and boundary-layer theory. When there is no separation, agreement is good. The theory also predicts the point at which the 'separation level' appears, but not the drag from then on. Small separations are found to be more detrimental to lift than to drag. Author

N76-23174# Sandia Labs., Albuquerque, N.Mex.
EFFECTS OF UNSYMMETRICAL STABILITY DERIVATIVE CHARACTERISTICS ON REENTRY VEHICLE TRANSIENT ANGULAR MOTION
A. E. Hodapp, Jr. Sep. 1975 37 p refs
(Contract AT(29-1)-789)
(SAND-75-0252) Avail: NTIS HC $4.00

Analytical results, numerical results, and results of digital flight simulations are presented for an investigation of the effects that unsymmetrical stability derivative characteristics have on the transient angular motion of slender rolling reentry vehicles. It is shown that in addition to changing the motion patterns, damping, and frequency relative to those for symmetrical missiles, unsymmetrical stability derivatives can cause an exponential growth of the transient angle of attack for flight conditions within the resonance region. Author (ERA)

N76-23175# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
PREDICTION OF THE PRESSURE OSCILLATIONS IN CAVITIES EXPOSED TO AERODYNAMIC FLOW
D. L. Smith and L. L. Shaw Oct. 1975 92 p refs
(AF Proj. 1471)
(AD-A018518; AFFDL-TR-75-34) Avail: NTIS CSCL 20/4

Cavities, or rectangular cutouts, exposed to fluid flow can produce an intense aero-acoustic environment. Past experience has shown that severe fluctuating pressures exist in open aircraft weapon bays under certain flight conditions. The aircraft designer must be able to predict the fluctuating pressure environment of cavities in order to assess the effects on the internally carried stores or near-by structure. Prediction methods were formulated based primarily on data from flight tests on cavities with length-to-depth-ratios of 4, 5 and 7 over a Mach number range of 0.6 to 1.30. Available data in the literature were then used to extend the range of application of the prediction method to cavities with length to depth ratios from 2 to 7 and for Mach numbers from 0.5 to 3.0. GRA

N76-23176# Frankford Arsenal, Philadelphia, Pa. Munitions Development and Engineering Directorate.
COMPUTER PROGRAM FOR GENERATING GYROSCOPIC AND DYNAMICS STABILITY FACTORS AS A FUNCTION OF RANGE
Diana L. Frederick Aug. 1974 49 p refs
(DA Proj. 1W6-62603-AM-78)
(AD-A019242; FA-TN-74020) Avail: NTIS CSCL 19/4

This report describes a computer program which gives gyroscopic and dynamic stability factors as a function of range by combining two existing programs, SPINNER and TRAJE. The program generates air-to-air, air-to-ground, and ground-to-ground trajectories. Inputs to the program are the aerodynamic coefficients obtained from SPINNER computer program, projectile weight and cross sectional area, projectile muzzle velocity, vehicle velocity, and initial angle of fire. Specific information provided includes time, velocity, spin, gyroscopic and dynamic stability factors, and altitude versus range for air-to-ground, air-to-air, and ground-to-ground trajectories. The air-to-ground and air-to-air trajectories include fixed wing and helicopter launchings. GRA

N76-23177# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
BOUNDARY LAYER TRANSITION ON BLUNT BODIES IN HYPERSONIC FLOW Interim Scientific Report, Dec. 1973 - May 1974
B. E. Richards Sep. 1975 44 p refs
(Grant AF-AFOSR-2227-72; AF Proj. 7381)
(AD-A018805; AFML-TR-75-139) Avail: NTIS CSCL 20/4

Heat transfer and pressure distributions were measured on a family of smooth and rough biconic models simulating reentry flow. The test conditions were selected to generate boundary layer transition data on these models. The heat transfer measurements agreed reasonably well with reference enthalpy prediction methods except for 0.004 inch mean element height wall roughness generated turbulent boundary layer cases when values measured were 35% higher than theory. GRA

N76-23178# Neilsen Engineering and Research, Inc., Mountain View, Calif.
PREDICTION OF AERODYNAMICS OF MISSILES AT HIGH ANGLES OF ATTACK IN SUPERSONIC FLOW Annual Technical Report, 1 Oct. 1974 - 30 Sep. 1975
Marnix F. E. Dillenius and Jack N. Nielsen Oct. 1975 205 p refs
(Contract N00014-74-C-0050; NR Proj. 215-226)
(AD-A018680; NEAR-TR-99) Avail: NTIS CSCL 20/4

Improvements have been added to a computer program previously reported in NEAR Technical Report 74 for calculating the loadings on cruciform wing-body combinations at supersonic speeds and it has been extended to wing-body-tail combinations. An improvement in the accuracy of calculating the pressures acting on the combination enables good agreement between experimental and theoretical fin forces and moments up to 20 deg to angle of attack. An option has been added to the computer program to include the effect of nose vortices on the loading of the canard fins and body. In addition, the necessary distributions of leading-edge and side-edge suction forces have been calculated to set up the model of the separation vortices from the leading edges and side edges of the canard fins using the Polhamus vortex-lift analogy. For the case considered, compressibility was shown to have little effect on the trajectories of vortices from the canard fins to the empennage. In addition, the effect of the nose and canard vortices on the cruciform tail forces and moments have been determined. Thus, the capability for determining the characteristics of a complete missile has been developed. A listing of the computer program and a calculative example are included. Extensive comparisons between the prediction of the computer program and experiment are included with generally good agreement. Author (GRA)

N76-23179# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE EFFECT OF A SHROUDED TAIL EXTENDER ON THE FLIGHT CHARACTERISTICS OF BLUFF 500-POUND-CLASS CONFORMAL BOMBS Final Report
Richard M. Hartley Jun. 1975 48 p refs
(WF32322204)
(AD-A019150; DTNSRDC/ASED-337) Avail: NTIS CSCL 19/2

A fineness-ratio two cylinder with modified box fins (called star fins) was proposed as a 500-pound class general purpose bomb suitable for conformal carriage on aircraft. Model and full-scale free-flight tests of the proposed shape showed that it was subject to pitch-yaw-roll interactions that developed into large-angle (45 degrees) coning motions. The configuration was modified by extending the fin assembly 1.3 diameters aft with a shroud and removing a front tending the fin assembly 1.3 diameters aft with a shroud and removing a front spoiler plate. The modified shape flew much more smoothly and with much less angular motion (generally 7 degrees or less). Both the original and modified shapes separated cleanly from the carriage aircraft (ejected by an Aero 7A rack from level flight near 3000 feet). GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-23180 Pennsylvania State Univ., University Park.
SUPPLY FUNCTIONS FOR SHORT-HAUL AIR TRANSPORTATION Ph.D. Thesis
Francis X. Mckelvey 1975 193 p
Avail: Univ. Microfilms Order No. 76-10761

Supply functions are generated for the individual aircraft used in the short-haul air transportation context. They are used to identify optimal aircraft to be employed under a variety of objective functions for various planning contexts. A measure of the quality of service, the level of service index, for short-haul air transportation is formulated which incorporates both the performance characteristics of aircraft and the operating and routing constraints found in the short-haul industry. This measure is used to gain a descriptive understanding of the performance of short-haul air transportation with respect to the private automobile. Several applications of the supply function are demonstrated to show the variety of its uses. Sensitivity analyses are conducted on the variables in order to discover the effect of certain operating and routing conditions on the quality of service. Dissert. Abstr.

N76-23181*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FULL-SCALE AIRCRAFT CABIN FLAMMABILITY TESTS OF IMPROVED FIRE-RESISTANT MATERIALS, TEST SERIES 2
Robert N. Stuckey, Richard W. Bricker, Jerome F. Kuminecz, and Daniel E. Supkis Apr. 1976 62 p refs
(NASA-TM-X-58172; JSC-10613) Avail: NTIS HC $4.50 CSCL 01C

Full-scale aircraft flammability tests in which the effectiveness of new fire-resistant materials was evaluated by comparing their burning characteristics with those of other fire-resistant aircraft materials were described. New-fire-resistant materials that are more economical and better suited for aircraft use than the previously tested fire-resistant materials were tested. The fuel ignition source for one test was JP-4; a smokeless fuel was used for the other test. Test objectives, methods, materials, and results are presented and discussed. The results indicate that, similar to the fire-resistant materials tested previously, the new materials decompose rather than ignite and do not support fire propagation. Furthermore, the new materials did not produce a flash fire. Author

N76-23182*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

USER'S GUIDE TO COMPUTER PROGRAM CIVM-JET 4B TO CALCULATE THE TRANSIENT STRUCTURAL RESPONSES OF PARTIAL AND/OR COMPLETE STRUCTURAL RINGS TO ENGINE-ROTOR-FRAGMENT IMPACT

Thomas R. Stagliano, Robert L. Spilker, and Emmett A. Witmer Mar. 1976 297 p refs
(Contract NGR-22-009-339)
(NASA-CR-134907; ASRL-TR-154-9) Avail: NTIS HC $9.25 CSCL 01C

A user-oriented computer program CIVM-JET 4B is described to predict the large-deflection elastic-plastic structural responses of fragment impacted single-layer: (a) partial-ring fragment containment or deflector structure or (b) complete-ring fragment containment structure. These two types of structures may be either free or supported in various ways. Supports accommodated include: (1) point supports such as pinned-fixed, ideally-clamped, or supported by a structural branch simulating mounting-bracket structure and (2) elastic foundation support distributed over selected regions of the structure. The initial geometry of each partial or complete ring may be circular or arbitrarily curved; uniform or variable thicknesses of the structure are accommodated. The structural material is assumed to be initially isotropic; strain hardening and strain rate effects are taken into account. Author

N76-23183# Institute for Defense Analyses, Arlington, Va. Div. of Science and Technology.

A REVIEW AND ANALYSIS OF THE RCA COLLISION AVOIDANCE SYSTEM, PHASE 1 Final Report, Jul. 1972 - Aug. 1973

James J. Bagnall, Jr., Irwin W. Kay, Arthur Keinitz, and Robert D. Turner Feb. 1976 179 p refs Sponsored by FAA
(Contract DAHC15-73-C-0200)
(AD-A022112/7; IDA-Study-S-426) Avail: NTIS HC $7.50 CSCL 01/2

Two collision avoidance systems (CAS) using RCA SECANT techniques are analyzed: VECAS designed for high performance aircraft and VECAS-GA designed for low performance aircraft. The two CAS use the Air Transport Association (ATA) collision avoidance logic and were evaluated in the 1971 FAA projection of traffic (800 aircraft) in 1982 in the Los Angeles basin. The CAS are asynchronous and employ beacon interrogator/transponder techniques, which introduce mutual interference. In the analysis a third equipment, the SECANT Proximity Warning Indicator (PWI), was modeled but not analyzed to determine levels of interference. The levels of interference are a function of the aircraft density, equipment mix, and equipment parameters. In the analysis the equipment mix was assumed to be 7 percent VECAS, 21 percent VECAS-GA, and 72 percent PWI in the most dense region below 10,000 ft altitude. For the above conditions, the VECAS equipment performs satisfactorily, but the VECAS-GA has inadequate detection range. If the VECAS-GA range is increased or the VECAS-GA is substituted for VECAS, the resultant interference level degrades the accuracy of the systems to the point that it is unsatisfactory and in some cases can reduce minimum alarm time to 10 seconds. Author

N76-23184# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

A REVIEW AND ANALYSIS OF THE HONEYWELL COLLISON AVOIDANCE SYSTEMS, PHASE 1, VOLUME 1

James J. Bagnall, Jr., Lawrence R. Dausin, and Robert D. Turner Feb. 1976 141 p refs Sponsored in part by FAA
(Contract DAHC15-73-C-0200)
(AD-A021949/3; IDA-Study-S-424-Vol-1; FAA-RD-73-151-Vol-1) Avail: NTIS HC $6.00 CSCL 01/2

Two collision avoidance systems (CAS) developed by Honeywell are analyzed. AVOIDS-1 designed for high performance aircraft and AVOIDS-2 designed for low performance aircraft. The two CAS use the Air Transport Association (ATA) collision avoidance logic and were evaluated in the 1971 FAA projection of traffic (800 aircraft) in 1982 in the Los Angeles basin. The CAS are asychronous and employ beacon interrogator/transponder techniques, which can lead to mutual interference among the CAS. Both types of equipment have adequate accuracy and detection range for aircraft from which they were designed. In the trackers of both systems false alarms can be generated because of false tracks which arise primarily from the interaction of real tracks. For the most likely configuration of both Honeywell CAS without inhibition logic, AVOIDS-1 with the typical antenna measured on the Boeing 737 and AVOIDS-2 with an omnidirectional antenna, the false alarm rate from false tracks is about 3 per hour in high density traffic. The incidence of false alarms from false tracks can be made negligible by improving the range resolution and by changing the logic to require an alarm to persist for two or more cycles (3 seconds for co-altitude and 6 seconds for nonco-altitude). Author

N76-23185# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

A REVIEW AND ANALYSIS OF THE HONEYWELL COLLISION AVOIDANCE SYSTEM, PHASE 1. VOLUME 2: APPENDICES Final Report, Jul. 1972 - Aug. 1973

James J. Bagnall, Jr., Lawrence R. Dausin, and Robert D. Turner Feb. 1976 155 p Sponsored by FAA
(Contract DAHC15-73-C-0200)
(AD-A021950/1; IDA-Study-S-424-Vol-2-App; FAA-RD-73-151-Vol-2-App) Avail: NTIS HC $6.00 CSCL 01/2

Two collision avoidance systems (CAS) are analyzed: AVOIDS-1 for high performance aircraft and AVOIDS-2 designed for low performance aircraft. The two CAS use the Air Transport Association (ATA) collision avoidance logic and were evaluated in the 1971 FAA projection of traffic (800 aricraft) in 1982 in the Los Angeles basin. The CAS are asynchronous and employ beacon interrogator/transponder techniques, which can lead to mutual interference among the CAS. Both types of equipment have adequate accuracy and detection range for aircraft for which they were designed. In the trackers of both systems false alarms can be generated because of false tracks which arise primarily from the interaction of real tracks. For the most likely configuration of both Honeywell CAS without inhibition logic, AVOIDS-1 with the typical antenna measured on the Boeing 737 and AVOIDS-2 with an omnidirectional antenna, the false rate from false tracks is about 3 per hour in high density traffic and may be of little concern to individual pilots. However, if such alarms are transmitted to the air traffic controllers, a controller may perceive as many as 200 per hour. Conversely, if such alarms are not transmitted, the aircraft may ignore or interrupt controller commanded maneuvers. The incidence of false alarms from false tracks can be made negligible by improving the range resolution and by changing the logic to require an alarm to persist for two or more cycles (3 seconds for co-altitude and 6 seconds for nonco-altitude). If the inhibition logic were retained the incidence of false tracks would be reduced by about a factor of 2-6, but real threatening tracks would be suppressed as much as 11 percent of the time in any cycle. Author

N76-23186# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INVESTIGATION OF PILOT SELF-BRIEFING TECHNIQUES. VOLUME 2: APPENDIXES Interim Report, Mar. - Oct. 1974

Hugh D. Milligan and Bruce L. Rosenberg Feb. 1976 137 p 2 Vol.
(AD-A022075/6; FAA-NA-75-18-Vol-2-App; FAA-RD-75-90-Vol-2-App) Avail: NTIS HC $6.00 CSCL 01/2

The usefulness was assessed of automation techniques and devices developed for the purpose of providing pilots with the

capability to obtain preflight weather briefings without the aid of a flight service station specialist. Both live and canned weather data were employed to ascertain the validity of the basic concepts and to define improvements thereto. The data elicited from the activities, thus far, indicates that pilot self-briefing is a feasible approach which portends delivery of quality weather briefing with a concomitant cost reduction when compared to the cost of today's and any future labor intensive briefing system. Information on design of the experiment, data collected, statistical analyses of results, and a summary narrative, conclusions and recommendations are included. Samples of the various briefings, the questionnaires used, and the pilots' responses where they opted to do so are presented. Author

N76-23187# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF AIRCRAFT FUEL TANK EXPLOSIONS AND NITROGEN INERTING REQUIREMENTS DURING GROUND FIRES Final Report, Sep. 1972 - Dec. 1974
Richard Hill and George R. Johnson Oct. 1975 81 p Original contains color illustrations
(AD-A021665/5; FAA-NA-75-25; FAA-RD-75-119) Avail: NTIS HC $5.00 CSCL 01/2

Nitrogen inerting was investigated as a means of preventing or minimizing explosions and/or reactions in aircraft fuel tanks under simulated crash-fire conditions. Tests were conducted on both small and large volume tanks, inerted to various concentrations (expressed in terms of O2 concentration by volume), containing different amounts of Jet-A or JP-4 fuel and heated at different rates. Results of these tests indicated that internal fire or explosion would not result from external heating or internal high-energy spark when the tank was inerted to an oxygen concentration lower than 10 percent. Author

N76-23188# McDonnell-Douglas Electronics Co., St. Charles, Mo.
TIME/FREQUENCY COLLISION AVOIDANCE SYSTEM EQUIPMENT. PHASE 1: DEVELOPMENT MODEL GROUND STATION AND ASSOCIATED AIRBORNE FEASIBILITY MODELS Final Report, Jul. 1973 - Dec. 1974
K. E. Toerper Dec. 1975 139 p refs
(Contract DOT-FA73WA-3239)
(AD-A021685/3; FAA-RD-75-223) Avail: NTIS HC$6.00 CSCL 01/2

The work is reported which was for Phase I development of Time/Frequency Collision Avoidance System (CAS) items. Work performed at MDEC is described and includes: system analysis, design and development, fabrication and assembly, integration and test, and documentation. Activities at NAFEC are also described and include: field training, preliminary functional tests, installation, and field acceptance test. Equipment delivered to NAFEC is described and includes: a dual channel ground station, airborne fly-by synchronization equipment, and feasibility models of airborne CAS units for both air carrier and general aviation. A complete list of references relating to contract documentation is included. The results of antenna measurements and reliability/maintainability studies are presented. Author

N76-23214 Transportation Systems Center, Cambridge, Mass.
PREDICTIVE TECHNIQUES FOR WAKE VORTEX AVOIDANCE
J. N. Hallock, W. D. Wood, and E. A. Spitzer *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 11 p refs (For availability see N76-23191 14-04)

N76-23215 Transportation Systems Center, Cambridge, Mass.
US/UK VORTEX MONITORING PROGRAM AT HEATHROW AIRPORT
J. N. Hallock and L. Goldstone (Civil Aviation Authority, London) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 9 p (For availability see N76-23191 14-04)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-23189# National Aerospace Lab., Tokyo (Japan).
STUDY OF AUTOMATIC FLARE CONTROL SYSTEM FOR AIRPLANE
Mikihiko Mori and Yuso Horikawa Oct. 1975 31 p refs In JAPANESE; ENGLISH Summary
(NAL-TR-433) Avail: NTIS HC $4.00

An efficient design procedure for an automatic flare control system was developed. Advantages of parallel path control law and exponential flare path are shown by analyzing the static and dynamic landing performance. The merits are that the pitch angle increases during the flare motion and becomes positive at touch down, thereby the angle of attack can be held near trim angle, removing the fear of going into stall. Two probable configurations for an automatic flare control system are an elevator control system for CTOL and a throttle control system for STOL. The synthesis of the former results in a control system which is composed of a pitch control autopilot as an inner loop, and an outer loop for height control to generate reference pitch attitude. The ground effect which produces lift and negative drag is taken into consideration, and a simple time-programmed throttle control system is proposed to compensate for the ground effect. It reduces the thrust gradually as an airplane comes near the ground, by which pitch-up touch down condition can be ensured. An example of numerical design and simulated computations of flare control for a medium-size turboprop transport is presented. Author

N76-23190*# Ohio Univ., Athens. Avionics Engineering Center.
SIMULATION ANALYSIS OF A MICROCOMPUTER-BASED, LOW-COST OMEGA NAVIGATION SYSTEM
Robert W. Lilley and Richard J. Salter, Jr. May 1976 10 p refs Presented at Bicentennial Natl. Symp. of the Inst. of Navigation, Warminster, Pa., 28 Apr. 1976
(Grant NGR-36-009-017)
(NASA-CR-147917; TM-26) Avail: NTIS HC $3.50 CSCL 17/7

The current status of research on a proposed micro-computer-based, low-cost Omega Navigation System (ONS) is described. The design approach emphasizes minimum hardware, maximum software, and the use of a low-cost, commercially-available microcomputer. Currently under investigation is the implementation of a low-cost navigation processor and its interface with an omega sensor to complete the hardware-based ONS. Sensor processor functions are simulated to determine how many of the sensor processor functions can be handled by innovative software. An input data base of live Omega ground and flight test data was created. The Omega sensor and microcomputer interface modules used to collect the data are functionally described. Automatic synchronization to the Omega transmission pattern is described as an example of the algorithms developed using this data base. Author

N76-23191# Advisory Group for Aerospace Research and Development, Paris (France).
PLANS AND DEVELOPMENTS FOR AIR TRAFFIC SYSTEMS
A. Benoit, ed. and D. R. Israel, ed. Feb. 1976 562 p refs Conf. held at Cambridge, Mass., 20-23 May 1975
(AGARD-CP-188) Avail: NTIS HC $13.50

Technological forecasting and automation of air traffic control systems are described. For individual titles, see N76-23192 through N76-23229.

N76-23192 Royal Aircraft Establishment, Bedford (England).
STUDIES OF AUTOMATIC NAVIGATION SYSTEMS TO IMPROVE UTILIZATION OF CONTROLLED AIRSPACE
K. Watling and R. C. Rawlings *In* AGARD Plans and Develop.

for Air Traffic Systems Feb. 1976 15 p refs (For availability see N76-23191 14-04)

It is shown that the use of improved navigation in controlled airspace in the future could produce useful savings in time and money within a short time. This conclusion is based on the optimum use of VOR/DME and will rely, from the start, on allowing reduced lateral and longitudinal separations by the provision of accurate statistically predictable performances. Certain en-route applications are possible which provide the means of assessing, at an early stage, the effectiveness of the improved systems and which provide the means of assessing, at an early stage, the effectiveness of the improved systems and which allow the development of more ambitious systems for the busy TMAs in the future. Author

N76-23193 Ecole Nationale Superieure de l'Aeronautique, Toulouse (France).

FOUR-D NAVIGATION IN TERMINAL ZONES: AN AUTOMATIC CONTROL PROBLEM

Marc J. Pelegrin *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 25 p refs In ENGLISH and FRENCH (For availability see N76-23191 14-04)

It is shown that, if a velocity profile is imposed upon the plane and controlled along a selected approach path, it is possible to limit the deviation from the computed arrival time of the plane at the ILS entry gate. Two simulation programs, a fast time one and one in real time, determine and control the optimum 4-D trajectory. The first results show that the accuracy of the simulation need not be very great; thus, the extra computing ground capacity is fairly limited. It can also be shown that an accurate descent trajectory is no problem for an aircraft equipped with an automatic throttle command. Moreover, a head-up display that gives the optimum glide slope angle allows a very accurate control of the plane along its longitudinal axis. Author

N76-23194 Boeing Commercial Airplane Co., Seattle, Wash.

STRATEGIC CONTROL OF TERMINAL AREA TRAFFIC

Ralph L. Erwin, Jr. *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 13 p refs (For availability see N76-23191 14-04)

An advanced method of controlling air traffic in high density terminal areas is reported. In this concept the air traffic control system defines four dimensional tracks for all arrivals that will derandomize and space the traffic for landing on the runway. The aircraft use four dimensional navigation and guidance equipment to fly the assigned paths. The advantages that result from a strategic control system using airborne four dimensional navigation and guidance equipment are presented; the resulting benefits of increased capacity and reduced fuel consumption are discussed. The logic used by the air traffic control authority to strategically control arrivals is described. This logic determines the sequence for handling the aircraft, establishes the time schedule for use of the runway by each flight, and calculates the four dimensional path to be assigned to each aircraft, recognizing the aeroperformance capabilities of the individual flight. The performance of the algorithm is demonstrated by the results of a fast time simulation of strategic control as applied to arriving traffic for Los Angeles International (LAX) Airport. Author

N76-23195 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

ATC CONCEPTS WITH EXTENSIVE UTILIZATION OF AUTOMATIC DATA PROCESSING

Horst Newmann *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 9 p (For availability see N76-23191 14-04)

Alternative concepts of electronic data processing supported ATC are outlined and technical and procedural problems are specified in each case. Emphasis is on conceivable planning functions and logical relations with air traffic control functions leading to semi-automatic air traffic control. There are two main effects of such an ATC concept utilizing automatic data processing extensively: (1) expedition of the air traffic flow and reduction of the load of both the planning and the radar controller, because automatic filtering of conflicts will be achieved; and (2) optimum balancing of the load, because automatic allocation of flights to controllers will permit more continuous control and guidance within joint control sectors. Author

N76-23196 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

OMEGA: A SYSTEM WHOSE TIME HAS COME

John F. Beran and John E. Bortz, Sr. (Analytic Sciences Corp., Reading, Mass.) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p refs (For availability see N76-23191 14-04)

The United States Air Force program to equip approximately 700 airlift aircraft with Omega navigation equipment is described. The program structure emphasizes obtaining low cost automatic equipment satisfying enroute air navigation performance requirements. Required equipment characteristics are identified and the structure of the equipment acquisition program is outlined. Several important Omega technology issues are discussed from a user's perspective. The paper concludes with a summary of the results of an Air Force flight test program designed to evaluate the important technology options now available in Omega navigation equipment. Author

N76-23197 Plessey Radar Ltd., Havant (England).

A SURVEY OF PRIMARY RADARS FOR AIR TRAFFIC SYSTEMS

K. Milne *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p refs (For availability see N76-23191 14-04)

Application areas for primary radars in air traffic systems are reviewed. Problems facing the designers of such radars are outlined. Minimization of ground clutter, precipitation clutter and angle echoes figure high on the list of desiderata, combined with the needs for adequate data rate and high equipment reliability. Approaches to the solutions of these problems are surveyed and examples given of current practice. Future trends in primary radars are discussed in the light of recent advances in automation and in signal processing techniques. Improvements in the immediate future are likely to be evolutionary in nature, aimed at making the performance of today's radars compatible with more automated control systems. Author

N76-23198 Federal Aviation Agency, Washington, D.C. Systems Research and Development Service.

ATCRBS IMPROVEMENT PROGRAM

Martin Natchipolsky *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p (For availability see N76-23191 14-04)

(ARD-241)

The Air Traffic Control Radar Beacon System (ATCRBS) experiences a number of problems such as false, broken, fading, missed and garbled targets. Although many factors contribute to the degradation of ATCRBS performance, most problems can be attributed to poor interrogator/receiver antennas, the difficulty of interrogator management, inadequate reply target detection and processing criteria or airborne transponder performance. A major development effort has been directed at improved interrogator antenna designs because the present FAA ATCRBS antenna is responsible for many of the system problems. Planned development efforts for improved ATCRBS reply processing and target detection are based on utilization of the improved antenna performance and sum difference pattern capability for monopulse processing. Author

N76-23199 Royal Radar Establishment, Malvern (England).

ADSEL/DABS: A SELECTIVE ADDRESS SECONDARY SURVEILLANCE RADAR

R. C. Bowes, P. R. Drouilhet (Lincoln Lab., MIT, Lexington), H. G. Weiss (Lincoln Lab., MIT, Lexington), and M. C. Stevens (Cossor Electronics Ltd., Harlow, Engl.) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 13 p refs Sponsored in part by FAA (For availability see N76-23191 14-04)

ADSEL/DABS (Address Selection/Discrete Address Beacon System) is a selectively addressed secondary radar system which is an extension of present day ATCRBS/SSR. The system provides the usual surveillance data, identity, height and position and in addition a data link communication facility is available on both the ground to air and air to ground channels. The system is entirely compatible with present day ATCRBS/SSR and introduction can take place over an extended period. A modified transponder is required in the aircraft which operates on both normal ATCRBS/SSR and ADSEL/DABS. The new ground stations can provide surveillance of aircraft fitted with existing

ATCRBS/SSR transponders as well as handling those with selective address transponders on board. An overall description of the system is given together with details of the message formats and modulation techniques adopted. Author

N76-23200 Elettronica S.R.L., Rome (Italy).
LEA MICROWAVE APPROACH AND LANDING SYSTEM
Roberto Nicoli *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 5 p (For availability see N76-23191 14-04)

The system operates in time sharing for terminal area navigation and landing or runway taxiing aids. In addition to the over 100 aircrafts that the system is capable of assisting in the landing phase, it can provide TMA navigation aid to several hundreds aircrafts inside a 30 n.m. radius area. The system utilizes a simple airborne equipment, while the ground equipment can be implemented at various degrees of sophistication, according to the airport size and traffic. Aircraft position data and identification are simultaneously available onboard and on the ground so that TMA and ATC are simplified. On the ground, ATC personnel have available data of all aircraft in TMA, landing or taxiing in the runways, complete with the aircraft indentification codes. The pilot has available onboard-- on standard cockpit instruments--the accurate position data of the aircraft in relation to the airport for TMA and to runway for landing. The ATC operator who monitors the aircraft situation on a scope gives ground-to-air instructions for TMA to the pilots and emergency communications for landing. Author

N76-23201 Naval Electronic Systems Command, Washington, D.C.
MATCALS: EXPANSION OF CAPACITY FOR EXPEDITIONARY AIRFIELDS
Richard R. Wilz (Marine Corps., Washington, D. C.) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 18 p (For availability see N76-23191 14-04)

The Marine Air Traffic Control and Landing System (MATCALS) is being implemented to upgrade and automate the ATC and all weather landing control capabilities of Marine Air Traffic Control Units (MATCU). The overall role of Marine Corps aviation is reviewed, and the crucial role and operational functions of the MATCU as a supporting element are described. An overview is presented of the MATCALS implementation program, the system as a whole, and the advanced capabilities which MATCALS will provide. Specific functional capabilities for air traffic management and control are indicated, and the technical approach toward implementing these functions is described. The MATCALS landing control capabilities and functions are then described, with emphasis on the operational advantages realized with an automated ground derived system. Finally, the impact of MATCALS on overall Marine aviation effectiveness is summarized. This summary emphasizes the quantitative factors by which MATCALS will increase the maximum rate of air firepower delivery through increased traffic handling capacity at expeditionary airfields. Author

N76-23202 Mitre Corp., McLean, Va.
ADVANCED ATC AUTOMATION: THE ROLE OF THE HUMAN IN A FULLY AUTOMATED SYSTEM
Richard A. Rucker *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p refs (For availability see N76-23191 14-04)

An overview is presented of one approach to formulating and evaluating an experimental model which automates routine en route sector traffic con rol. Basic design concepts are identified, and the automated control tasks performed by the Front Royal sector model, a digital computer simulation, are discussed. The paper then focuses on the anticipated roles and responsibilities of the journeyman air traffic controller in such an environment and how en route sector position designs may further evolve as a result. The purpose is to explore some long range implications and potentials from the perspective of the air traffic controller. Author

N76-23203 Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
THE PROVISION AND USE OF INFORMATION ON AIR TRAFFIC CONTROL DISPLAYS
V. David Hopkin *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 12 p refs (For availability see N76-23191 14-04)

Several kinds of mismatch can occur at the man machine interface in air traffic control systems. One, often overlooked, concerns the provision of certain essential information in a form which is unusable. The traditional reliance on the man's strengths of adaptability and flexibility in order to match man and machine in the system is thwarted if he cannot use the information presented to him. Changes from qualitative to quantitative information, incomplete automation, and the apparent retention of decision making roles which in fact have been greatly modified, all pose problems of ensuring that the displayed information has been adapted successfully. Author

N76-23204 Stanford Research Inst., Menlo Park, Calif. Transportation Engineering and Control Group.
AUTOMATION OF LOCAL FLOW CONTROL AND METERING OPERATIONS IN THE ENROUTE/TRANSISTION ENVIRONMENT
Robert S. Ratner *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 7 p (For availability see N76-23191 14-04)

Local flow control procedures are described that are used when a sector of the enroute/transition airspace becomes saturated, in terms of the workload or control capacity of the sector control team. The procedures are generally implemented according to prespecified plans, and take the form of restrictions on the permissible in-trail inter-aircraft separation for traffic flows upstream of the impacted sector. The desirability of enhancing this process of local flow control is discussed. A concept, termed planning control, for enhancing local flow control operations through automation, is described. The concept is based on prediction of prospective traffic levels on routes and in sectors within an air route traffic control center, using the on-line traffic data base of the NAS Enroute Stage A system. Appropriate flow control restrictions, are instituted whenever control workload in a sector exceeds a standard level. Author

N76-23205 Royal Air Force, Farnborough (England). Mathematics Dept.
THE OPTIMISATION OF TRAFFIC FLOW AROUND A NETWORK
V. W. Attwooll *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 6 p (For availability see N76-23191 14-04)

The use of flow control is considered for air routes subject to saturation. Alterations to intended flight times at the planning stage penalize the operator, but so do the delays from congestion which occur if such alterations are not made. Hence there is an optimum balance which can be expressed as a planning target flow rate on a given route. For a network of routes subject to constraints, similar considerations lead to an optimum planned distribution of traffic flow around the system. The assessment of this optimum can become complex and is best handled by computer optimization techniques. The use of such techniques may become inevitable when the increasing complexity of route systems and constraints makes it impracticable for the unaided human brain to approach an optimum traffic distribution. Our study is illustrated by examples of traffic conditions at the England/France boundary. Author

N76-23206 Eurocontrol Agency, Brussels (Belgium).
THE INTRODUCTION OF ACCURATE AIRCRAFT TRAJECTORY PREDICTIONS IN AIR TRAFFIC CONTROL
A. Benoit, J. Storey, and S. Swierstra *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 28 p refs (For availability see N76-23191 14-04)

A family of methods is proposed for predicting the trajectory of an aircraft of which a limited past history is known from radar observations at the time the prediction is produced as well as the intentions available from flight plan data. The approach is particularly designed to accommodate climbing and descending traffic and, in consequence, the paper concentrates on the vertical component of the trajectory prediction. Author

N76-23207 Royal Radar Establishment, Malvern (England).
INTERACTIVE CONFLICT RESOLUTION IN AIR TRAFFIC CONTROL
R. G. Ball, R. B. Lloyd, and G. Ord *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 14 p refs (For

availability see N76-23191 14-04)

Aircraft of the major operators are becoming more and more capable of flying trajectories well defined in space and time. Such trajectories offer distinct advantages to operators and could also offer advantages to controllers for planning conflict free situations in the tactical phase of control. However, in order to use them, it is necessary for controllers to be able to visualize the trajectories further into the future, and in greater detail, than they can at present. A technique is outlined for improving the controller's visualization ability by using computer assistance to provide a predictive display. The technique is capable of being extended to help the controller with conflict detection and resolution. An important feature of the extension is that it allows the controller to conduct a dialogue with the computer enabling him to try out various options, the outcome of each of these being displayed so that he can assess the consequences of any action. The paper also discusses how the computer can assist with monitoring that aircraft remain on trajectories which are conflict free. Author

N76-23208 Federal Aviation Agency, Washington, D.C.
INTERMITTENT POSITIVE CONTROL: A GROUND-BASED COLLISION AVOIDANCE SYSTEM
Michael E. Perie, B. M. Horowitz (MITRE Corp.), A. L. McFarland (MITRE Corp.), J. U. Beusch (Lincoln Lab., MIT), and K. D. Senne (Lincoln Lab., MIT) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 17 p refs (For availability see N76-23191 14-04)

Intermittent Positive Control (IPC) is a totally automated ground based collision avoidance system. It functions by taking positive control of Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) aircraft on an as needed basis to avoid hazardous encounters. By also providing pilots with continuous information on the location of nearly aircraft, it results in safety in controlled, mixed, and uncontrolled airspace, among all users (air carrier, general aviation and military) in both IFR and VFR flight, while maintaining the freedom of action associated with VFR flight. To receive IPC service an aircraft must carry a Discrete Address Beacon System (DABS) transponder and an IPC display. The transponder, in addition to its beacon function, receives digital messages from the ground and presents them on the IPC display. The ground portion of the IPC system consists of the DABS sensor and an IPC computer. Author

N76-23209 Thomson-CSF, Bagneux (France).
INTEGRATED NAVIGATION SYSTEM: MULTIFUNCTION
Ljubimko Milosevic *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 43 p In ENGLISH and FRENCH (For availability see N76-23191 14-04)

The multifunction integrated navigation system is designed in an homogeneous manner for radio navigation aid functions. It carries out navigation, surveillance with identification, anticollision, data transmission and voice communications functions. It is compatible with either direct ground to air transmission links or indirect satellite transmission links. It significantly simplifies aircraft equipment. It features modular extensible design and it is practically a non-saturable system. Two overall views of the system utilization are either with enroute T/R ground stations or using satellites to cover the enroute space. Author

N76-23210 Mitre Corp., McLean, Va. Air Transportation Systems Div.
FUTURE ATC TECHNOLOGY IMPROVEMENTS AND THE IMPACT ON AIRPORT CAPACITY
Richard M. Harris *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 14 p refs (For availability see N76-23191 14-04)
(Contract DOT-FA70WA-2448)

The United States is presently in its third generation of air traffic control systems and technology. This third generation system is the first nationwide application of modern computer based technology to the management of traffic in the national airspace system. Twenty NAS Stage A enroute installations are now in place at the domestic air route traffic control centers. In addition, 61 automated radar terminal systems are now installed and operational in the major terminal areas. Linkages between these enroute and terminal facilities are presently being established and verified. Upon completion of the installation and testing the U.S.A. will have operational a large scale, semi-automated capability to provide highly improved ATC services for domestic medium, high altitude, and terminal airspace. Author

N76-23211 Royal Radar Establishment, Malvern (England).
SECONDARY RADAR FOR GROUND MOVEMENT CONTROL c09
Hugh N. Griffiths *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 9 p (For availability see N76-23191 14-04)

A method of using secondary radar for ground movement identification is outlined which could have sufficient positioned accuracy to label a high definition primary radar display of airfield ground movements. An experimental ground movement secondary radar installation at an airfield site is described and the results of trials are discussed. Methods for improving the performance of the basic system are indicated and possible future developments are suggested. Author

N76-23212 Transportation Systems Center, Cambridge, Mass.
ATCRBS TRILATERATION, THE ADVANCED AIRPORT SURFACE TRAFFIC CONTROL SENSOR c09
J. W. Ogrady, M. J. Moroney, and R. E. Hagerott *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 20 p refs (For availability see N76-23191 14-04)

The requirements of an advanced Airport Surface Traffic Control (ASTC) system have been developed and the technology identified for the sensor part of the system. Employing Air Traffic Control Radar Beacon System (ATCRBS) replies from aircraft transponders and trilateration receivers for accurate position location and vehicle identification, the sensor system satisfies the performance and readiness requirements of intermediate (1980) goal systems. The advanced ATCRBS trilateration sensor for ASTC has been analytically established and a brassboard system is being fabricated to provide empirical validation. Author

N76-23213 Service Technique de la Navigation Aerienne, Paris (France).
THE CORAIL SURVEILLANCE SYSTEM FOR AIRPORT RUNWAYS [SYSTEME CORAIL DE SURVEILLANCE DE PISTES D'AEROPORT] c09
Jean Marc Faysse and Guy Georges Plottin (Laboratoire Central de Telecommunications) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 18 p In FRENCH and ENGLISH (For availability see N76-23191 14-04)

The prototype CORAIL radar installed on the Paris Orly airport runway and originally intended only for automatic runway surveillance under conditions of poor visibility has proven itself to be a powerful facility for controlling runway and approach corridor movements in real time, making it possible to increase the frequency of aircraft landings and takeoffs, even in clear water, whilst maintaining a high level of safety. Author

N76-23214 Transportation Systems Center, Cambridge, Mass.
PREDICTIVE TECHNIQUES FOR WAKE VORTEX AVOIDANCE c03
J. N. Hallock, W. D. Wood, and E. A. Spitzer *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 11 p refs (For availability see N76-23191 14-04)

Aircraft wake vortices represent a major impediment to increasing runway capacity. Separation criteria are conservative most of the time and thus traffic unnecessarily delayed by always adhering to the present inflexible regulations. Systems which employ vortex tracking sensors and/or meteorological sensors to determine safe reduced spacings are being designed. Any wake vortex avoidance strategy relies upon the ability to predict vortex transport and decay. The paper discusses vortex behavior, preliminary predictive models based upon the tracking of vortices from over 24,000 landing aircraft, and systems and their implementation to provide the capability of using adaptive separations. Author

N76-23215 Transportation Systems Center, Cambridge, Mass.
US/UK VORTEX MONITORING PROGRAM AT HEATHROW AIRPORT c03
J. N. Hallock and L. Goldstone (Civil Aviation Authority, London) *In* AGARD Plans and Develop. for Air Traffic Systems Feb.

1976 9 p (For availability see N76-23191 14-04)

Vortices shed from aircraft landing are being recorded and analyzed and their motion correlated with ambient meteorological conditions. It is shown that if the crosswind component measured near the runway threshold exceeds five knots, vortices linger near the extended runway centerline for a time in excess of one minute for less than 0.5 percent of the landings. This small percentage is almost entirely due to vortices from the heavy wide body jets -- the B747, DC-10 and L-1011. Author

N76-23216 Linde A.G., Munich (West Germany).
FOG DISPERSAL AT AIRPORTS, THE STATE OF THE ART AND FUTURE TRENDS **c09**
W. Baldus, F. V. Melewicz (DOT, Washington, D. C.), A. Pocrnja, K. Ruppert, J. F. Sowar (DOT, Washington, D. C.), and H. Wenzel *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 6 p refs (For availability see N76-23191 14-04)

Cold fog is being dispersed routinely by airborne seeding with dry ice and results show a favorable benefit to cost ratio. Also ground based systems of liquid propane dispensers are used operationally for cold fog dispersal. Warm fog dispersal being more difficult has become operational at two airports of Paris. Improved prospects of economic warm fog dissipation are offered by a new heat pump system with favorable thermodynamic properties which result in an essentially lowered requirement. The artificial visibility improvement by fog dispersal systems is considered a valuable aid for safe aircraft operation under all weather conditions. Author

N76-23217 Federal Aviation Administration, Washington, D.C.
UNITED STATES PROGRAM TO ICAO FOR A NEW NON-VISUAL APPROACH AND LANDING SYSTEM
Joseph M. DelBalzo and Stanley R. Jones (Mitre Corp., McLean, Va.) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 20 p (For availability see N76-23191 14-04)

The microwave landing system is a precision approach and landing guidance system designed to meet the needs of all types of aircraft, civil and military, throughout the world through at least the balance of this century. It is an air derived data system, i.e., ground stations will generate coded signals which will enable an airborne receiver/processor unit to derive precise azimuth angle, elevation angle, and range data, which are suitable for display to the pilot or for use by an automatic flight control system. Inherent in the MLS design is the incorporation of a ground-to-air data link which will provide runway identification, condition of runway, operational status of the MLS, and weather information. An important element in the concept is that of performance modularity wherein a range of equipment configurations, both ground based and airborne, would be responsive to the operational requirements and economic considerations of each category of user. Author

N76-23218 Transportation Systems Center, Cambridge, Mass.
INSTRUMENT LANDING SYSTEM PERFORMANCE PREDICTION
Gerald Chin, Lawrence Jordań, David Kahn, and Stephen Morin *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 14 p refs (For availability see N76-23191 14-04)

A physics model based on electromagnetic scattering theory has been developed for predicting comparative Instrument Landing System (ILS) localizer and glide slope antennas array performance and course structure degradation resulting from a change to an airport environment. The theoretical predictions of the localizer model were compared with flight test data from Syracuse-Hancock airport. The agreement was good. The glide slope model has been used to predict and compare the perfromance of three image type antennas: The null reference sideband reference and capture effect antennas for non flat terrain configurations. It was found that acceptable course results often could be found with only one type of glide slope antenna without performing a major terrain regrading. Author

N76-23219 Marconi Radar Systems Ltd., Leicester (England). Airfield Instrumentation.
MEASUREMENTS OF RUNWAY VISUAL RANGE
I. A. C. Stage *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 11 p refs (For availability see N76-23191 14-04)

This review of the measurement of runway visual range returns to the basic recommendation of the International Civil Aviation Organization as the basis of a fundamental appraisal of the instrumentation and system requirements. The definition of the operational requirement contains an assessment of the instrumentation task and stresses the need for representativeness in the measurement. The processes of selecting and developing the instrumentation techniques using supporting data processing are shown to provide superior system performance. Results from evaluation trails demonstrate the superior performance of an automated runway visual range system over the observer in providing operationally useful data. In conclusion, the paper discusses future requirements and instrumentation techniques for supplementary visibility assessment. Author

N76-23220 Federal Aviation Administration, Washington, D.C.
INDEPENDENT LANDING MONITORS/SURVEY REPORT
Guice Tinsley *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 2 p refs (For availability see N76-23191 14-04)

Continued interest over a numbe: of years in independent landing monitor systems has resulted in proposals for widely varying techniques and devices to give the pilot a check on the primary instrument landing system and an assurance that the approcah and landing is proceeding safely. An independent assessment that an approach is progressing safely may be essential for operator acceptance of approach guidance based on a single electronic signal. Current related developments are summarized to include concept, technical characteristics, and development status. For programs presently undergoing testing, a brief summary of test results is included. Author

N76-23221 Royal Radar Establishment, Malvern (England).
COMPUTER ASSISTED APPROACH SEQUENCING
J. M. Bonny *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1967 7 p (For availability see N76-23191 14-04)

An experimental prototype system is described that is being developed on behalf of the civil aviation authority, to investigate the feasibility of providing computer assistance in the approach sequencing task at Heathrow airport. Author

N76-23222 Transportation Systems Center, Cambridge, Mass.
ADVANCED AIR TRAFFIC AMANGEMENT SYSTEM STUDY
Robert H. Reck *In* Agard Plans and Develop. for Air Traffic Systems Feb. 1976 11 p refs (For availability see N76-23191 14-04)

Plans for the advanced air traffic management system for the late 1980's and beyond are summarized. The plans are presented in the framework of an evolutionary system concept of traffic management building upon the upgraded third generation air traffic control system, and designed to meet the projected demands for service, safety, and flexibility in a cost effective manner. The advanced air traffic management system concept is characterized by the use of satellite to supplement ground equipment for aircraft surveillance, navigation, and communication over the United States and nearby oceanic regions; strategic flight planning and control for flight in dense traffic regions; centralization of the control system; and a high level of automation. A program of research and development is described to provide the information needed for planning future system developments. Author

N76-23223 Advisory Group for Aerospace Research and Development, Paris (France).
FUTURE AIR TRAFFIC CONTROL SYSTEMS, A PRELIMINARY STUDY
In its Plans and Develop. for Air Traffic Systems Feb. 1976 19 p (For availability see N76-23191 14-04)

The results of this study particularly emphasize the vital importance both of the place of man in the system, and of the environmental factors affecting the efficiency of the air traffic controller and the pilot, especially in the context of increasing automation. It is firmly believed that future planning will not be successful unless these two user professions are closely involved in it. A predominantly directive method of air traffic control rather than a totally permissive one is evisioned for the future. Furthermore, predictable penalties associated with a pre-planned

traffic flow are to be preferred to the chance penalties associated with a random distribution of traffic. At the same time it is imperative to reduce all possible penalties associated with the system to an acceptable minimum. Author

N76-23224 Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
APPLICATIONS OF THE AIRBORNE TRAFFIC SITUATION DISPLAY IN AIR TRAFFIC CONTROL
Mark E. Connelly *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 12 p refs (For availability see N76-23191 14-04)

The potential usefulness of displaying traffic and map information in an aircraft cockpit and the effects that the availability of such information would have on ATC procedures and capacities are evaluated. These tests indicate that the ATSD is a valuable aid to the pilot in executing the following basic functions: conflict detection and resolution, conforming to airspace structures, precise spacing in trail, merging, sequencing, monitoring runway occupancy, backup procedures after an ATC failure, approach to one of two closely spaced parallel runways operating independently, and taxiing on the airport surface. A simulation study of a terminal area metering and spacing system in which computer generated commands were transmitted directly to the pilots showed that the introduction of the ATSD eliminated all violations of spacing minimums and cut the dispersion of arrival times at the runway threshold in half. When the ATC generated metering and spacing schedule was made available to the pilots and their flight instruments modified to assist them in executing a 4DRNAV approach corresponding to the schedule, the dispersion of arrival time errors at the runway threshold was reduced to less than three seconds. Author

N76-23225 Raytheon Co., Wayland, Mass. Equipment Div.
A NEW SYSTEM ARCHITECTURE FOR ATC AUTOMATION
Paul E. Hamburger *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 13 p refs (For availability see N76-23191 14-04)

Automation of the National Airspace System (NAS) is well underway with both enroute and terminal control centers successfully converted to atuomation. These systems are based on interfacing radar outputs to high resolution displays through one or more large scale computers which provide a variety of automation functions, the most important of which are tracking controlled aircraft and formating alphanumeric data blocks for the associated aircraft. Recent studies for air traffic control systems outside the United States have shown that for applications with less concentrated traffic, a system architecture in which numerous minicomputers share the processing task, has significant advantages in cost, reliability and modularity. By being modular, the numner of minicomputers required can be tailored to the size of the air traffic control center, and the computer program size can be tailored to the functional complexity warranted by the country's size, traffic level, and sophistication desired. In designing such systems, minicomputers are assigned to functions in one of two ways: either functions are subdivided and minicomputers are assinged to each subfunction, or a function performed in a similar way many times is subdivided so that several minicomputers perform the function once, or at most a few times. Author

N76-23226 Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONUS AERONAUTICAL RADIONAVIGATION BY SATELLITE
Irvin G. Stiglitz *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 5 p refs Sponsored by DOT (For availability see N76-23191 14-04)

A variety of satellite system concepts have been promulgated as solutions to the CONUS ATC problems. By categorizing these, it is possible to draw some generally valid observations about the characteristics of each of them. By selecting system architectures, representative of each category, key technical aspect of systems within each category can be explored. Critical aspects illuminated include avionics complexity, required number of satellites, system vulnerability, capacity, required ground processing, and accuracy. Author

N76-23227 Department of Transport, Ottawa (Ontario).
AERONAUTICAL SATELLITE SYSTEM (AEROSAT) c15
J. Ruden and J. Thomas *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p (For availability see N76-23191 14-04)

An experimental aeronautical satellite program is being undertaken on an international basis to provide a satellite system and to evaluate the ability of such a system to meet future air traffic control requirements over oceanic regions. The reasons for undertaking such a program are outlined. The system itself is described and the principal parameters, which will be evaluated to assess performance and establish standards for any future satellite system, are discussed. Author

N76-23228 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Human Engineering Group.
MEASUREMENTS OF THE CONTROL CAPACITY OF ATC SYSTEM
Klaus Joachim Brauser *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 13 p refs (For availability see N76-23191 14-04)

Three methods of measuring the executive control load and control capacity have been developed and applied: (1) the measurement of the total time consumption of all executive control tasks generated by all a/c movements occurring in the area of jurisdiction of the executive controller; The time saturation condition indicates that the executive control load is approximating the saturation, i.e. the control capacity; (2) the measurement of a well defined partial work load which has been proved to be average constant part of the total workload, this partial work load being the R.T. channel load; and (3) controller questionnaires on estimates of their control capacity. Author

N76-23229 Royal Radar Establishment, Malvern (England).
A MEASURING ROD FOR ATC SYSTEMS, THE INDEX OF ORDERLINESS
H. Gent *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 8 p refs (For availability see N76-23191 14-04)

The index of orderliness is considered as a measuring rod for ATC systems which gives a numerical estimate of system performance at any moment of time. Its calculation requires a basis for conflict prediction and a threat weighting formula. The index is then defined as a weighted count of future conflicts. The index of orderliness/time curves produced by a collision avoidance system simulation is discussed. It is shown that such curves contain valuable information on the response time of the system. This time structure is displayed via calculation of the autocorrelation function of an index of orderliness graph. The relation of the Index to a complete ATC system viewed as a hierarchy of control loops is presented and shown to be close. Finally it is suggested that indices of orderliness can be used to give a quantitative measure of the style of an ATC system, as well as of its performance. Author

N76-23230# National Aviation Facilities Experimental Center, Atlantic City, N.J.
RESULTS OF SIMULATION EXPERIMENTS DESIGNED TO SHOW THE EFFECT OF TONE BURST DISTURBANCE UPON AIR TRAFFIC CONTROL AIR/GROUND COMMUNICATIONS Final Report, Mar. - Apr. 1975
Robert G. Mulholland Feb. 1976 37 p refs
(AD-A022076/4; FAA-NA-75-44; FAA-RD-75-187) Avail: NTIS HC $4.00 CSCL 17/7

Results of simulation of sectors in the New York Air Route Traffic Control Center (ARTCC), New York Common IFR (instrument flight rules) Room, and terminals within the New York control area are described. The simulation experiments were designed to show the effect of a proposed Federal Communication Commission (FCC) regulation concerning tone burst identification of privately owned transmitters on air traffic control (ATC) air/ground voice communications. The results are presented in output data showing the effect of tone burst duration on communications delay and channel utilization over both long (2-hour) and short (1-minute) term time durations for nine distinct sector types. The unmistakable conclusion is that implementation of the proposed regulation will adversely affect air/ground communications unless some way is found to prevent tone burst

identification procedures from extending the duration of pilot-initiated transmissions. Author

N76-23231# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF TERMINAL INFORMATION PROCESSING SYSTEM CONCEPT 1 FOR INSTRUMENT FLIGHT RULES ROOM Final Report, Apr. - Jun. 1975
Theodore Rundall Feb. 1976 40 p refs
(AD-A022355/2; FAA-NA-75-50; FAA-RD-75-184) Avail: NTIS HC $4.00 CSCL 17/7

A method of presenting flight data on the automated radar terminal system (ARTS III) plan view display (PVD), for use in high-density terminal facilities, was evaluated. Consideration was given to the alphanumeric writing demands, the controllers' ability to read alphanumerics from various positions around the PVD, and the operational air traffic control (ATC) aspects of the concept. The method tested did not excessively burden the alphanumeric writing capability of the ARTS III. The controllers were able to read the alphanumerics satisfactorily. Author

N76-23232# Ohio Univ., Athens. Avionics Engineering Center.
INDEX TO ILS/VOR-RELATED TOPICS CONTAINED IN TECHNICAL REPORTS PRODUCED BY THE OHIO UNIVERSITY AVIONICS ENGINEERING CENTER DURING THE PERIOD 1965-1975 Interim Report
Harry L. Graham Dec. 1975 38 p refs
(Contract DOT-FA69WA-2066-MOD-16)
(AD-A022431/1; EER-5-23; FAA-RD-76-35) Avail: NTIS HC $4.00 CSCL 17/7

An index and bibliography are presented covering all ILS and VOR R and D work performed at Ohio University and reported in 19 major technical reports over the years 1965-75. Author

N76-23233# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
REVIEW AND ANALYSIS OF SOME COLLISION AVOIDANCE ALGORITHMS WITH PARTICULAR REFERENCE TO ANTC-117 Final Report
James J. Bagnall, Jr. and Irvin W. Kay Jun. 1975 171 p refs
(Contract DOT-FA74WA-3498)
(AD-A021635/8; IDA-Study-S-450; FAA-RD-75-72) Avail: NTIS HC $6.75 CSCL 01/2

The results of an assessment of those parts of ANTC-117 that deal with threat evaluation and maneuver selection logics are presented. Of primary concern were two questions: (1) whether the threat evaluation logics of ANTC-117 provide sufficient time for performing maneuvers necessary to achieve safe separation and (2) whether in dense traffic the expected number of alarms occur infrequently enough for the CAS to practical. The answers to both questions were found to be negative. The possibility of modifying the threat-evaluation techniques to achieve safe separation was investigated and found to be feasible. However, attempts to reduce the expected alarm rate to tolerable levels proved unsucessful. It is postulated that existing ATC procedures or modifications thereof can substantially reduce the alarm rates by altering the aircraft range and range rate distributions that were assumed and which are the source of the excessive alarm rate. Author

N76-23234# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGN VALIDATION OF THE NETWORK MANAGEMENT FUNCTION
P. H. Mann and H. F. Vandevenne 2 Feb. 1976 54 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; Proj. 034-241-012)
(AD-A021722/4; ATC-54; FAA-RD-75-113) Avail: NTIS HC $4.50 CSCL 17/7

The results of a major design validation effort of the Network Management function in the DABS Engineering Requirements document was described. The design validation is based on simulation of a DABS network of three sensors interacting with airborne traffic of approximately 800 aircraft. Author

N76-23235# Systems Technology, Inc., Hawthorne, Calif.
INSTRUMENT LANDING SYSTEM LOCALIZER ALIGNMENT AND STRUCTURE MODEL Final Report, 29 Oct. 1974 - 29 Sep. 1975
W. F. Clement, L. G. Hofmann, and J. A. Klein (Rockwell Intern. Corp.) May 1975 102 p refs
(Contract DOT-FA74WA-3340)
(AD-A021636/6; TR-1043-3; FAA-RD-75-102) Avail: NTIS HC $5.50 CSCL 17/7

Nonstationary statistical analysis of flight inspection data for 13 Category II and Category II-training Localizer facilities is used to obtain statistical models for the Localizer alignment error and structure. Models for these two components of Localizer anomalies are given in terms of two linear differential equations and Gaussian probability density functions especially useful for landing system performance analysis. The structure component of the received Localizer guidance signal is found to be stationary, to have a standard deviation of 2.47 A, and a characteristic length of 1,309. ft. The alignment error component of the received Localizer guidance signal is found to have a mean of 2.25 A (probably due to the relatively small sample of different Localizer facilities), and a standard deviation of 4.92 A. Author

N76-23236# Federal Aviation Administration, Washington, D.C.
ANALYSIS, FLIGHT TEST AND EVALUATION OF HONEYWELL, MCDONNELL-DOUGLAS AND RCA AIRBORNE COLLISION AVOIDANCE SYSTEMS (ACAS)
Jan. 1976 56 p refs
(AD-A021097/1; FAA-RD-76-17) Avail: NTIS HC $4.50 CSCL 01/2

Three Airborne Collision Avoidance Systems (ACAS), designed and built by Honeywell, McDonnell-Douglas and RCA respectively, were evaluated as part of the aircraft separation assurance program. The evaluation consisted of analyses, simulations and maneuver selection logics developed by the Air Transportation Association ACAS technical working group as a standard for comparison. The results show that the Honeywell system is superior form both a cost and technical performance standpoint. Author

N76-23237# Institute for Defense Analyses, Arlington, Va. Div. of Science and Technology.
A REVIEW AND ANALYSIS OF THE SIERRA DME COLLISION AVOIDANCE SYSTEM Final Report, Jul. 1974 - Sep. 1975
Arthur Krinitz Oct. 1975 124 p refs Sponsored by FAA
(Contract DAHC15-73-C-0200)
(AD-A021634/1; S-456) Avail: NTIS HC $6.00 CSCL 01/2

The SIERRA's concept for a collision avoidance system, referred to as DME/CAS is analyzed. The DME/CAS is an air-derived synchronous concept intended to exploit the proliferated network of DME ground facilities to obtain synchronization and to adapt airborne DME designs for time-sharing between the DME and CAS functions. DME ground facilities would be augmented to transmit a CAS time reference signal, in addition to normal DME replies; airborne clocks would be synchronized to the received reference, after correction for the propagation delay obtained by DME techniques. Synchronized CAS participants transmit and receive one-way range and encoded altitude signals for threat evaluation in accordance with the ANTC-117 threat logic. The areas addressed include the impact of time sharing between DME and CAS functions; the impact of various interference mechanisms (fruit, co-slot and adjacent slot occupancy, multipath), and threat parameter measurement accuracies. The main findings of the study are summarized. Author

N76-23238# McDonnell-Douglas Electronics Co., St. Charles, Mo.
MINICAS FIELD ACCEPTANCE TEST RESULTS Final Report, Nov. 1974 - Dec. 1974
K. E. Toerper Dec. 1975 42 p refs
(Contract DOT-FA73WA-3239)
(AD-A021688/1; FAA-RD-75-224) Avail: NTIS HC $4.00 CSCL 01/2

The results and preliminary conclusions derived from the field acceptance test of feasibility model airborne Time/Frequency

Collision Avoidance System equipment are summarized. The equipment described includes general aviation-type MiniCAS units which employ time differenced range measurements to digitally derive range rate. Analyses of communication reliability, time synchronization accuracy, range rate accuracy, and CAS-threat response for a limited sample of acceptance test data are included. Author

N76-23239# National Aviation Facilities Experimental Center, Atlantic City, N.J.

TEST AND EVALUATION OF THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM ELECTRONIC SCAN ANTENNA (SPECIFICATION TESTS) Interim Report, Jan. 1974 - Apr. 1975

Anthony D. Bradley Jan. 1976 84 p refs

(AD-A021062/5; FAA-NA-75-23; FAA-RD-75-212) Avail: NTIS HC $5.00 CSCL 17/7

The air traffic control radar beacon system (ATCRBS) electronic scan antenna (ESA) consists of 56 array modules placed on a platform (ring) constructed around the top of an airport surveillance radar tower. A shelter beneath the tower provides an enclosure for the control and radiofrequency (RF) distribution system of the ESA. The specification tests conducted to determine compliance with portions of the engineering requirement applicable to field testing are described. It was concluded that the ESA performed the basic functions of beam stepping, agile beam repositioning, beam hopover, and the generation of side-lobe suppression (SLS), improved SLS (ISLS), sum channel, and difference antenna beam pattern characteristics. The data obtained during the effort met the specification requirements, taking into account field environmental effects. Author

N76-23240# Texas Instruments, Inc., Dallas.

LOCALIZER TRAVELING WAVE ANTENNA FAULT DETECTION Final Report, Oct. 1974 - Jul. 1975

Ronald Fossier Jul. 1975 73 p

(Contract DOT-FA73WA-3289)

(AD-A020989/0; FAA-RD-75-164) Avail: NTIS HC $5.00 CSCL 17/7

Technique was developed to provide fault detection of any or all opens and shorts in the TWA antenna transmission, monitor lines, and antenna elements of the 14 element directional course array and the six element clearance array. In addition, one preproduction system was built, tested, and installed at a designated FAA facility. Author

N76-23241# Ohio Univ., Athens. Avionics Engineering Center.

INVESTIGATION OF EFFECTS OF GROUND-PLANE DEEP SNOW COVER ON IMAGE GLIDE SLOPE 1974-75 Final Report, Nov. 1974 - Aug. 1975

Richard H. McFarland Aug. 1975 37 p refs

(Contract DOT-FA75WA-3581)

(AD-A021690/3; EER-24-1; FAA-RD-75-210) Avail: NTIS HC $4.50 CSCL 17/7

Results of the tenth consecutive year of data collection concerning snow effects on operation of image glide-slope systems are presented. Evidence continues to show that with snow on the reflecting ground plane, the far-field glide slope does not lower; rather it tends to rise approximately one-tenth of one degree elevation per one foot depth of snow. Further, the conventional near-field, 180 deg point monitor response does not correlate with far-field path perforamnce when snow covers the ground. A two-frequency, capture-type far-field monitor was tested. At sites where deep snows exist, high snow banks accumulate alongside the runway, which affect the path angle and structure just beyond the runway threshold. Author

N76-23242# National Aviation Facilities Experimental Center, Atlantic City, N.J.

STAGGER/DESTAGGER MODIFICATIONS FOR THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM Final Report, Nov. 1974 - Jun. 1975

Paul Todd and Nicholas Talotta Nov. 1976 58 p refs

(AD-A021835/4; FAA-NA-75-59; FAA-RD-75-193) Avail: NTIS HC $4.50 CSCL 17/7

The air traffic control radar beacon system was modified so as to eliminate false or second-time-around aircraft replies. A dual-channel stand-alone modification equipment unit was developed to stagger the beacon interrogations and destagger the reply video. The unit can be used with any beacon interrogator defruiter or processor. Two models, an analog and a digital, were developed. The resulting equipments were implemented and tested at the Bedford, Virginia, long-range radar facility. During the engineering tests and operational evaluation, the stagger modification performed reliably. It is recommended that the digital version be implemented at the field facilities. Author

N76-23243# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

A REVIEW AND ANALYSIS OF THE HONEYWELL COLLISION AVOIDANCE SYSTEM, PHASE 2 Final Report

Lawrence R. Dausin Oct. 1975 150 p refs

(Contract DOT-FA74WA-3498)

(AD-A021735/6; IDA-Study-S-460; FAA-RD-75-151) Avail: NTIS HC $6.00 CSCL 01/2

Honeywell has proposed two levels of equipment for use in collision avoidance; the AVOIDS-I is and AVOIDS-II. The AVOIDS-I intended for use by high-performance aircraft and can handle encounters between aircraft with closing speeds up to 2,000 ft/sec. The threat evaluation logic of the AVOIDS-I is patterned after the ATA logic, but some minor differences exist. The AVOIDS-II equipment is intended for use by low-performance aircraft. It was assumed that the AVOIDS-II emloyed the same logic as AVOIDS-I operating at altitudes below 10,000 ft where maximum speed is restricted. The results of the analysis indicate the false alarm rate for both the Honeywell AVOIDS-I and assumed AVOIDS-II will not be excessive when operated in the peak density forecast by the FAA for the 1982 Los Angeles Basin. The FAA forecasts about eight false alarms per hour for all aircraft in the 1982 Los Angeles Basin. The average false alarm rate per aircraft is expected to be less than one per 100 hours. The detection probability of the CAS was assessed assuming the communication range of the equipment was adequate to insure sufficient data for threat evaluation. A missed detection will cause a delay in warning and the probability of a delay in warning for one or two threat evaluation periods is about 2 percent. The probability of a delay in warning of more than two threat evaluations is very small and can be ignored. Author

N76-23244# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

A REVIEW AND ANALYSIS OF THE RCA COLLISION AVOIDANCE SYSTEM, PHASE 2 Final Report

James J. Bagnall, Jr. and Irvin W. Kay Oct. 1975 104 p refs

(Contract DOT-FA74WA-3498)

(AD-A021672/1; IDA-Study-S-462; FAA-RD-75-152) Avail: NTIS HC $5.50 CSCL 01/2

An analysis is presented of RCA's aircraft collision avoidance systems, known as the SECANT VECAS and the SECANT VECAS-GA. The evaluation is based on the threat logic of ANTC-117. The RCA equipment, consisting of reasonable assumed mix of VECAS, VECAS-GA, and a proximity warning indicator in its present design configurations, meets the relevant specifications and otherwise conforms to the intent of ANTC-117. Some minor difficulties remain, the most significant of which is the possible delay in tracking one of two targets with nearly the same range. Also, VECAS-GA should be provided with 32 rather than 16 trackers for operation in high-density traffic. Author

N76-23245# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.

ENGINEERING AND DEVELOPMENT PROGRAM PLAN FLIGHT SERVICE SYSTEM

Feb. 1976 67 p

(AD-A021837/0; FAA-ARD-440-2; FAA-ED-13-1) Avail: NTIS HC $4.50 CSCL 17/7

The program required to design, develop, and implement a modernized and automated Flight Service System capable of satisfying the forecast 1990 demand for services is described. Program objective, approach, development activities, expected results, and resource requirements are set forth. The modernized Flight Service System supports the basic concept of fewer facilities and self-briefing. Author

N76-23246# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A REVIEW AND ANALYSIS OF THE MCDONNELL DOUGLAS COLLISION AVOIDANCE SYSTEM, PHASE 1
Lawrence R. Dausin and James J. Bagnall, Jr. Feb. 1976 66 p refs Sponsored in part by FAA
(Contract DAHC15-73-C-0200)
(AD-A021678/8; IDA-Study-S-415; FAA-RD-73-143) Avail: NTIS HC $4.50 CSCL 01/2

The Collision Avoidance System (CAS) development by McDonnell Douglas is analyzed. Factors examined include: the capability of the CAS to operate in a dense air traffic environment such as that expected in the Los Angeles basin (LAX) in 1982; problems associated with airborne equipment synchronization and multiple slot occupany and their effect on reducing system capacity; and the tau alarm accuracy. The number of time slots available for aircraft users exceeds the total number of aircraft in the 1982 forecast for LAX and therefore serious problems are not anticipated in this environment as long as the airborne equipment are each capable of selecting a unique message slot in which to operate. However, the analysis shows that the present procedures and equipment design will allow a large number of multiple slot occupancies to occur. Several ways to eliminate the major cause of multiple slot occupancy are mentioned. The analysis of tau alarm accuracy revealed that at low closing rates an excessive delay in a tau alarm may occur if the equipment performs in accordance with the ATA specifications. Because most of the delay arises from correlated errors in range and range rate measurements, the occurrence can persist for several epochs. Author

N76-23247# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A REVIEW AND ANALYSIS OF THE MCDONNEL DOUGLAS COLLISION AVOIDANCE SYSTEM, PHASE 2 Final Report
Arthur Krinitz Oct. 1975 92 p refs
(Contracts DOT-FA74WA-3498; DAHC15-73-C-0200)
(AD-A021679/6; IDA-Study-S-458; FAA-RD-75-143) Avail: NTIS HC $5.00 CSCL 01/2

The system is an air-derived synchronous one based on time/frequency multiplexing techniques-synchronization timing is disseminated by ground stations and by air-to-air relay among appropriately equipped aircraft. Two areas were analyzed: (1) range and range-rate measurement accuracies, and (2) synchronization limitations due to garbling of synchronization signals. The first area, range-rate measurement accuracy, was re-examined because of design changes, i.e., replacement of Doppler measurements with range difference measurements. The second area, synchronization, was addressed in some detail to complement the Phase I study. In particular, the limitations imposed by transmitter power, antenna nulls/fades, and receiver sensitivity were analyzed in the context of the air-to-air synchronization relay links. Results are presented and discussed. Author

N76-23248# Air Force Academy, Colo. Frank J. Seiler Research Lab.
SOFTWARE TO AUTOMATE GUIDANCE EXPERIMENTS (STAGE), VERSION 2 Final Report
Jimmie E. Shaver and Thomas S. Vandezande Jul. 1975 104 p refs
(AF Proj. 7904)
(AD-A018603; SRL-TR-75-0011) Avail: NTIS CSCL 17/7

This report documents the final version of Software to Automate Guidance Experiments, Version II (or STAGE II), and a FORTRAN -- callable version called STAGE III. Implemented on a SEL 810B minicomputer, STAGE II provides the facility to interactively set up an experiment with great flexibility in parameters for test table control, data acquisition, gyro electronic excitation, and limits checking. Control of the experiment is performed on a real time basis, with 100 channels of data recorded for subsequent analysis with background routines. Stage III provides the capability for executing control and data acquisition parameters that may be determined from previous experimental results using d-optimal design algorithms written in FORTRAN. This report serves both users and programmers by describing the system, its application, and providing details of the system logic in the appendices, with appropriate descriptions of files and program interfaces. Details of the use of each background analysis program are also included in the appendices. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-23249*# ECON, Inc., Princeton, N.J.
AN ASSESSMENT OF THE BENEFITS OF THE USE OF NASA DEVELOPED FUEL CONSERVATIVE TECHNOLOGY IN THE US COMMERCIAL AIRCRAFT FLEET
6 Oct. 1975 84 p refs Revised
(Contract NASw-2781)
(NASA-CR-148148; Rept-75-163-1) Avail: NTIS HC $5.00 CSCL 01C

Cost and benefits of a fuel conservative aircraft technology program proposed by NASA are estimated. NASA defined six separate technology elements for the proposed program: (a) engine component improvement (b) composite structures (c) turboprops (d) laminar flow control (e) fuel conservative engine and (f) fuel conservative transport. There were two levels postulated: The baseline program was estimated to cost $490 million over 10 years with peak funding in 1980. The level two program was estimated to cost an additional $180 million also over 10 years. Discussions with NASA and with representatives of the major commercial airframe manufacturers were held to estimate the combinations of the technology elements most likely to be implemented, the potential fuel savings from each combination, and reasonable dates for incorporation of these new aircraft into the fleet. Author

N76-23250*# Boeing Vertol Co., Philadelphia, Pa.
IDENTIFYING AND ANALYZING METHODS FOR REDUCING THE ENERGY CONSUMPTION OF HELICOPTERS
S. J. Davis and H. J. Rosenstein Nov. 1975 267 p refs
(Contract NAS1-13624)
(NASA-CR-144953; D210-11007-1) Avail: NTIS HC $9.00 CSCL 01C

The results are presented of a study to identify those helicopter technology areas which would result in the largest energy (or fuel) savings when applied to large tandem (100 passenger) civil helicopters in the 1985 time frame. Baseline aircraft using 1975 technology in the areas of powerplant, rotor efficiency, parasite drag and structure were sized to a very short haul mission of 100 N.M. and a short haul mission of 200 N.M. A systematic parametric analysis was then conducted to assess the impact of technology improvements. Projections of the technology levels that could be obtained in the 1985 time frame were made and the resources estimated to achieve them. Based on these data, the highest payoff (lowest energy) helicopter technologies are identified. Author

N76-23251*# Kanner (Leo) Associates, Redwood City, Calif.
A CLOSED FORM VARIATIONAL SOLUTION OF STRATOSPHERIC CRUISE FLIGHTS WITH MINIMUM DIRECT OPERATING COSTS
Bernd Faber Washington NASA May 1976 29 p refs Transl. into ENGLISH from Z. Flugwissenchaften (Germany), v. 23, Oct. 1975 p 346-356
(Contract NASw-2790)
(NASA-TT-F-17052) Avail: NTIS HC $4.50 CSCL 01C

For stratospheric quasi-steady cruise flight (supersonic or subsonic), optimal flight conditions for minimum operating costs are presented in a closed form. Constant power setting and thrust variations proportional to air density are assumed. When these assumptions conform to practical conditions, the drag polar may be of arbitrary shape. Drag polar, thrust and fuel consumption depend on the Mach number in arbitrary but defined form. A constant wind parallel to the flight path and the reduction of the aircraft weight due to fuel consumption are taken into account. Minimum fuel as well as minimum time cruising trajectories are contained in the solution as special cases. Author

N76-23252*# Lockheed-California Co., Burbank.
YF-12 LOCKALLOY VENTRAL FIN PROGRAM, VOLUME 1 Final Report
R. J. Duba, A. C. Haramis, R. F. Marks, L. Payne, and R. C. Sessing 9 Jan. 1976 453 p Sponsored by NASA and USAF 2 Vol.
(NASA-CR-144971) Avail: NTIS HC $12.00 CSCL 01C

Results are presented of the YF-12 Lockalloy Ventral Fin Program which was carried out by Lockheed Aircraft Corporation - Advanced Development Projects for the joint NASA/USAF YF-12 Project. The primary purpose of the program was to redesign and fabricate the ventral fin of the YF-12 research airplane (to reduce flutter) using Lockalloy, and alloy of beryllium and aluminum, as a major structural material. A secondary purpose, was to make a material characterization study (thermodynamic properties, corrosion; fatigue tests, mechanical properties) of Lockalloy to validate the design of the ventral fin and expand the existing data base on this material. All significant information pertinent to the design and fabrication of the ventral fin is covered. Emphasis throughout is given to Lockalloy fabrication and machining techniques and attendant personnel safety precautions. Costs are also examined. Photographs of tested alloy specimens are shown along with the test equipment used. Author

N76-23253*# Lockheed-California Co., Burbank.
YF-12 LOCKALLOY VENTRAL FIN PROGRAM, VOLUME 2 Final Report
R. J. Duba, A. C. Haramis, R. F. Marks, L. Payne, and R. C. Sessing 9 Jan. 1976 157 p refs 2 Vol.
(NASA-CR-144972) Avail: NTIS HC $6.75 CSCL 01C
For abstract, see N76-23252.

N76-23254# Committee on Armed Services (U. S. Senate).
ENFORCER AIRCRAFT
Washington GPO 1975 151 p Hearing before Subcomm. on R and D of Comm. on Armed Services, 94th Congr., 1st Sess., 29-30 Jul. 1975
(GPO-56-607) Avail: Subcomm. on R and D

The hearings concerning the capabilities of the Enforcer as a Close Air Support Aircraft are reported. F.O.S.

N76-23255# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARMY PRELIMINARY EVALUATION YAH-1R IMPROVED COBRA AGILITY AND MANEUVERABILITY HELICOPTER Final Report, 17 Feb. - 7 Mar. 1975
Robert L. Stewart, Floyd L. Dominick, Jr., and Raymond B. Smith May 1975 35 p refs
(AD-A018420; USAAEFA-74-33) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted in 1975 on preliminary evaluation of the improved Cobra agility and maneuverability helicopter, designated the YAH-1R. During the test, 17 flights were flown for a total of 20.0 flight hours, 12.9 of which were productive. Testing was limited to an evaluation of aircraft handling qualities with emphasis on low-speed flight characteristics at gross- weights of approximately 10,000 pounds. Numerous recommendations are made concerning improvement to the power management system of the YAH-1R helicopter. A total of 15 shortcomings were identified. GRA

N76-23256# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIRCRAFT FLIGHT PERFORMANCE METHODS Final Report, Jun. 1974 - Jul. 1975
Linn Earl Miller and Phillip G. Koch Jul. 1975 284 p
(AF Proj. 1366)
(AD-A018547; AFFDL-TR-75-89) Avail: NTIS CSCL 01/1

This report addresses the problems associated with the derivation of aircraft performance characteristics. The emphasis is on segments which are a part of a mission profile. In particular, the following areas are studied: takeoff, climb, cruise, descent and glide, turning, and landing. The generalized approach to performance estimates is first presented. Next, appropriate solutions are derived. Last, sensitivity relationships are developed. The relationships determine changes in the performance characteristics as a result of an aircraft configuration change. This permits rapid evaluation of the performance variations for any segment of a mission profile. Author (GRA)

N76-23290 Air Force Armament Lab., Eglin AFB, Fla.
AIRCRAFT/STORES COMPATIBILITY ANALYSIS AND FLIGHT TESTING
Charles S. Epstein *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 13 p refs (For availability see N76-23283 14-09)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-23257*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AERODYNAMIC CHARACTERISTICS OF A VANE FLOW ANGULARITY SENSOR SYSTEM CAPABLE OF MEASURING FLIGHT PATH ACCELERATIONS FOR THE MACH NUMBER RANGE FROM 0.40 TO 2.54
Glenn M. Sakamoto Washington May 1976 45 p refs
(NASA-TN-D-8242; H-900) Avail: NTIS HC $4.00 CSCL 14B

The aerodynamic characteristics of the angle of attack vane and the angle of sideslip vane are summarized. The test conditions ranged in free stream Mach number from 0.40 to 2.54, in angle of attack from -2 deg to 22 deg, in angle of sideslip from -2 deg to 12 deg, and in Reynolds number from 590,000 per meter to 1.8 million per meter. The results of the wind tunnel investigation are compared with results obtained with similar vane configurations. Comparisons with a NACA vane configuration are also made. In addition, wind tunnel-derived upwash for the test installation is compared with analytical predictions. Author

N76-23258# Instrument Flight Center, Randolph AFB, Tex.
FIVE-INCH VERTICAL SCALE TAPE ALTIMETER AND AIRSPEED INDICATOR EVALUATION Final Report
Manuel H. Tapia, Vibert L. Strock, and Gabriel P. Intano Nov. 1975 25 p
(IFC Proj. TE-72-1)
(AD-A018446; IFC-TN-75-2) Avail: NTIS CSCL 01/4

The Research and Development Division of the USAF Instrument Flight Center conducted a pilot factors evaluation of a 5-inch vertical scale altimeter and a vertical scale airspeed indicator to determine the utility and suitability of the displays. Fifteen subject pilots in the Instrument Flight Center were used for the evaluation. Each subject pilot flew two sorties of approximately 1.2 hours: duration in the RD T-38 aircraft. Based on the responses of the subject pilots and observations of the project pilots, the Instrument Flight Center deems it inadvisable to adopt the altimeter display as either a primary or standby instrument without major modifications. The proposed modifications are to include a command altitude marker, enlarge the numerals on the tape, expand the 100-foot scale, redesign the 1000-foot scale to reduce or eliminate reading errors, and incorporate a vertical velocity indicator tape display. The airspeed display was considered adequate for inclusion in USAF aircraft as both a primary and secondary display. The modifications recommended by the subject pilots are to include an airspeed command marker, change the scaling to 5-knot increments to increase reading accuracy, and include a mach indicator. These modifications will not affect the basic adequacy of the airspeed display but will enhance its overall readability and utility.
Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-23259 British Library Lending Div., Boston Spa (England).
INVESTIGATIONS OF VIBRATIONS OF TURBINE BLADES OF EXHAUST TURBOCHARGERS
H. Ludewig Dec. 1975 23 p refs Transl. into ENGLISH from Motortech. Z. (West Germany), v. 29, no. 10, 1968 p 408-414
(BLL-RTS-9989) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 16 BLL overseas or 40 UK BLL photocopy coupons

Devices for measuring vibrations of turbine blades in the laboratory and in service are described. Possible causes of blade vibrations are noted, and some results of measurements made on turbine blades of exhaust turbochargers on diesel engines are given. Recommendations are given for vibration-safe operation. Author

N76-23260*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC RESEARCH ENGINE/ AEROTHERMODYNAMIC INTEGRATION MODEL: EXPERIMENTAL RESULTS. VOLUME 3: MACH 7 COMPONENT INTEGRATION AND PERFORMANCE
Earl H. Andrews, Jr. and Ernest A. Mackley Apr. 1976 442 p refs Prepared in cooperation with AiResearch Mfg. Co., Torrance, Calif.
(Contract NAS1-6666)
(NASA-TM-X-72823) Avail: NTIS HC $11.75 CSCL 21E

The NASA Hypersonic Research Engine Project was undertaken to design, develop, and construct a hypersonic research ramjet engine for high performance and to flight test the developed concept on the X-15-2A airplane over the speed range from Mach 3 to 8. Computer program results are presented here for the Mach 7 component integration and performance tests. Author

N76-23261*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF LOW ASPECT RATIO, HIGHLY LOADED BLADING FOR COMPRESSORS. PART 9: STAGE F AND STAGE G, VOLUME 1 Final Report
J. G. Cheatham, J. D. Smith, and D. L. Wright May 1976 261 p refs
(Contract NAS3-11158)
(NASA-CR-134993; PWA-FR-7033-Pt-9-Vol-1) Avail: NTIS HC $9.00 CSCL 21E

Two single-stage, 0.77 hub/tip ratio axial-flow compressors were tested to evaluate the effectiveness of low aspect ratio blading as a means of obtaining higher stage loadings. One compressor, designated Stage F, was comprised of circular arc blading with an aspect ratio of 0.9 for both the rotor and stator. This compressor was tested with uniform inlet flow, hub radial, tip radial, and 180 deg arc circumferential inlet distortion. The second compressor, designated Stage G, was comprised of multiple circular arc blading with an aspect ratio of 1.0 for both the rotor and stator. This compressor was tested with uniform inlet flow only. Design rotor tip speeds for Rotor F and Rotor G were 285 m/sec (934 ft/sec) and 327 m/sec (1,074 ft/sec) respectively. Both stages operated at high loading levels with adequate efficiency and operating range. The peak efficiencies and corresponding average stage diffusion factors for Stages F and G at design rotor speed were 86.4% and 84.1% and 0.59 and 0.55 respectively. The surge margin at peak efficiency for Stage F was 12.6% and the corresponding value for Stage G was 16.5%. Both stages experienced a loss in efficiency with increasing rotor speed; however, the multiple circular arc rotor delayed the characteristic loss in efficiency within increasing Mach number to higher Mach number. Author

N76-23262*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF LOW ASPECT RATIO, HIGHLY LOADED BLADING FOR COMPRESSORS. PART 9: STAGE F AND STAGE G. VOLUME 2: DATA SUPPLEMENT Final Report
J. G. Cheatham, J. D. Smith, and D. L. Wright May 1976 236 p
(Contract NAS3-11158)
(NASA-CR-134994; PWA-FR-7033-Pt-9-Vol-2) Avail: NTIS HC $8.00 CSCL 21E

For abstract, see N76-23261.

N76-23263*# Kanner (Leo) Associates, Redwood City, Calif.
SOME MODELS FOR CALCULATING POLLUTANT EMISSION OF GAS TURBINE COMBUSTION CHAMBERS
F. Suttrop Washington NASA May 1976 39 p refs Transl. into ENGLISH of rept. DLR-IB-353-73/9 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz. (West Germany), Nov. 1973 44 p
(Contract NASw-2790)
(NASA-TT-F-17011; DLR-IB-353-73/9) Avail: NTIS HC $4.00 CSCL 21E

Possible chemical reactor models are specified. These models are widely used but provide no prediction of flow details and species distribution within a combustion chamber. The semi-empirical models must be fitted with experimental data, e.g., describing the flow conditions of mixture ratios at certain sections of the combustion chamber. It can be expected that the described procedures should allow the prediction of gas turbine pollutant emission with satisfactory reliability and acceptable computational requirements. Author

N76-23264*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC RESEARCH ENGINE/ AEROTHERMODYNAMIC INTEGRATION MODEL, EXPERIMENTAL RESULTS. VOLUME 1: MACH 6 COMPONENT INTEGRATION
Earl H. Andrews, Jr. and Ernest A. Mackley Apr. 1976 376 p refs Prepared in cooperation with AiResearch Mfg. Co., Los Angeles, Calif.
(Contract NAS1-6666)
(NASA-TM-X-72821) Avail: NTIS HC $10.75 CSCL 21E

The NASA Hypersonic Research Engine (HRE) Project was initiated for the purpose of advancing the technology of airbreathing propulsion for hypersonic flight. A large component (inlet, combustor, and nozzle) and structures development program was encompassed by the project. The tests of a full-scale (18 in. diameter cowl and 87 in. long) HRE concept, designated the Aerothermodynamic Integration Model (AIM), at Mach numbers of 5, 6, and 7. Computer program results for Mach 6 component integration tests are presented. Author

N76-23265*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE COMPARISONS OF SINGLE AND TWO STAGE DEMONSTRATOR FANS FOR ADVANCED TECHNOLOGY AIRCRAFT
Marcus F. Heidmann 1976 18 p refs Proposed for Presentation at the Third Aeroacoustics Conf., Palo Alto, Calif., 20-23 Jul. 1976; sponsored by AIAA
(NASA-TM-X-71899; E-8688) Avail: NTIS HC $3.50 CSCL 20A

A high-speed single-stage and a low-speed two-stage fan were designed, fabricated, and tested to demonstrate their predicted low noise performance for an advanced 0.85-0.90 cruise Mach number aircraft requiring a 1.8-1.9 pressure ratio fan. Acoustic tests were made with both unsuppressed and suppressed configurations. The two-stage fan demonstrated that quiet fan technology developed for low-speed single-stage fan is applicable to two-stage designs. The unsuppressed high-speed single-stage fan demonstrated that significant reductions in inlet noise can be achieved from the sonic blockage caused by supersonic flow in the rotor blading. Both fans demonstrated

suppressed inlet noise levels with treated sonic inlets that met advanced technology goals. Author

N76-23266*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS FROM SCREENING TESTS OF COMMERCIAL CATALYSTS WITH POTENTIAL USE IN GAS TURBINE COMBUSTORS. PART 1: FURNACE STUDIES OF CATALYST ACTIVITY
David N. Anderson 1976 21 p refs Presented at Workshop on Catalytic Combust., Raleigh, N. C., 25-26 May 1976: sponsored by EPA
(NASA-TM-X-73410; E-8742) Avail: NTIS HC $3.50 CSCL 21E

Thirty commercially produced monolith and pellet catalysts were tested as part of a screening process to select catalysts suitable for use in a gas turbine combustor. The catalysts were contained in a 1.8 centimeter diameter quartz tube and heated to temperatures varying between 300 and 1,200 K while a mixture of propane and air passed through the bed at space velocities of 44,000 to 70,000/hour. The amount of propane oxidized was measured as a function of catalyst temperature. Of the samples tested, the most effective catalysts proved to be noble metal catalysts on monolith substrates. Author

N76-23267*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF THE POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR TURBOPROP ENGINES
Edward J. Mularz 1976 13 p refs Proposed for Presentation at the Twelfth Propulsion Conf., Palo Alto, Calif., 26-29 Jul. 1976; Cosponsored by AIAA and SAE
(NASA-TM-X-71911; E-8713) Avail: NTIS HC $3.50 CSCL 21E

A program was performed to evolve and demonstrate advanced combustor technology aimed at achieving the 1979 EPA standards for turboprop engines (Class P2). The engine selected for this program was the 501-D22A turboprop. Three combustor concepts were designed and tested in a combustor rig at the exact combustor operating conditions of the 50-D22A engine over the EPA landing-takeoff cycle. Each combustor concept exhibited pollutant emissions well below the EPA standards, achieving substantial reductions in unburned hydrocarbons, carbon monoxide, and smoke emissions compared with emissions from the production combustor of this engine. Oxides of nitrogen emissions remained well below the EPA standards, also. Author

N76-23268*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE REDUCTION AS AFFECTED BY THE EXTENT AND DISTRIBUTION OF ACOUSTIC TREATMENT IN A TURBOFAN ENGINE INLET
Gene L. Minner and Len Homyak 1976 18 p refs Presented at 3d Aero-Acoustics Conf., Palo Alto, Calif., 20-22 Jul. 1976; sponsored by AIAA
(NASA-TM-X-71904; E-8693) Avail: NTIS HC $3.50 CSCL 20A

An inlet noise suppressor for a TF-34 engine designed to have three acoustically treated rings was tested with several different ring arrangements. The configurations included: all three rings; two outer rings; single outer ring; single intermediate ring, and finally no rings. It was expected that as rings were removed, the acoustic performance would be degraded considerably. While a degradation occurred, it was not as large as predictions indicated. The prediction showed good agreement with the data only for the full-ring inlet configuration. The underpredictions which occurred with ring removal were believed a result of ignoring the presence of spinning modes which are known to damp more rapidly in cylindrical ducts than would be predicted by least attenuated mode or plane wave analysis. Author

N76-23269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS FROM SCREENING TESTS OF COMMERCIAL CATALYSTS WITH POTENTIAL USE IN GAS TURBINE COMBUSTORS. PART 2: COMBUSTION TEST RIG EVALUATION
David N. Anderson 1976 26 p refs Presented at Workshop on Catalytic Combustion, Raleigh, N. C., 23-26 May 1976; sponsored by EPA
(NASA-TM-X-73412; E-8744) Avail: NTIS HC $4.00 CSCL 21E

Several commercial monolithic catalysts were tested in a combustion test rig to determine their suitability for use in a gas turbine combuster primary zone. The catalyst test bed consisted of two to four elements of 12-centimeter diameter by 2.5-centimeter long monolith. Results are presented of the measured combustion efficiency and catalyst bed temperature history for an inlet propane-air mixture temperature of 800 K, a pressure of 300,000 newtons per square meter, inlet velocities of 10 to 25 meters per second and equivalence ratios of 0.1 to 0.3. The best catalysts tested gave combustion efficiencies of virtually 100 percent for reaction temperatures ranging from 1,325 K at 10 meters per second to 1,400 K at 25 meters per second. This performance was only possible with fresh catalysts. The catalysts tested were not specifically developed for use at these conditions and showed some loss in activity after about 3 hours' testing. Author

N76-23270*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF NITRIC OXIDE EMISSIONS FROM A COMBUSTOR Patent Application
Roger A. Craig and Huw O. Pritchard, inventors (to NASA) (York Univ., Toronto) Filed 7 May 1976 16 p
(NASA-Case-ARC-10814-1; US-Patent-Appl-SN-684045) Avail: NTIS HC $3.50 CSCL 21E

A turbojet combustor and method for controlling nitric oxide emissions is provided by employing successive combustion zones wherein after combustion of an initial portion of the fuel in a primary combustion zone, the combustion products of the primary zone are combined with the remaining portion of fuel and additional plenum air and burned in a secondary combustion zone under conditions that result in low nitric oxide emissions. Low nitric oxide emissions are achieved by a novel turbojet combustor arrangement which provides flame stability by allowing stable combustion, to be accompanied by low nitric oxide emissions resulting from controlled fuel-lean combustion, ignited by the emission products from the primary zone, in a secondary combustion zone at a lower combustion temperature resulting in low emissions of nitric oxide. NASA

N76-23271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSIONS OF OXIDES OF NITROGEN FROM AN EXPERIMENTAL PREMIXED-HYDROGEN BURNER
David N. Anderson Washington May 1976 20 p refs
(NASA-TM-X-3393; E-8664) Avail: NTIS HC $3.50 CSCL 21E

Flame-tube experiments using premixed hydrogen and air were conducted to determine the emissions of oxides of nitrogen (NOx) resulting from ultralean combustion. Measurements of NOx emissions and combustion efficiency were made for inlet mixture temperatures of 600 and 700 K, pressures of 3.8 x 10 to the 5th power and 5.2 x 10 to the 5th power N/m squared, reference velocities of 15 to 18 m/sec, and equivalence ratios of 0.2 to 0.4. At the 700 K inlet mixture temperature, NOx emissions were 0.06 ppmv, and combustion efficiency was 98 percent at an equivalence ratio of 0.24. The use of a high-blockage (92-percent blockage) flameholder made it possible to conduct tests without upstream burning in the premixing duct for mixtures with equivalence ratios less than 0.4. For richer mixtures upstream burning did occur and prevented further testing.Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-23272*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

PRACTICAL ASPECTS OF A MAXIMUM LIKELIHOOD ESTIMATION METHOD TO EXTRACT STABILITY AND CONTROL DERIVATIVES FROM FLIGHT DATA
Kenneth W. Iliff and Richard E. Maine Washington Apr. 1976 34 p refs
(NASA-TN-D-8209; H-908) Avail: NTIS HC $4.00 CSCL 01C

A maximum likelihood estimation method was applied to flight data and procedures to facilitate the routine analysis of a large amount of flight data were described. Techniques that can be used to obtain stability and control derivatives from aircraft maneuvers that are less than ideal for this purpose are described. The techniques involve detecting and correcting the effects of dependent or nearly dependent variables, structural vibration, data drift, inadequate instrumentation, and difficulties with the data acquisition system and the mathematical model. The use of uncertainty levels and multiple maneuver analysis also proved to be useful in improving the quality of the estimated coefficients. The procedures used for editing the data and for overall analysis are also discussed. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N76-23273* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR REDUCING AERODYNAMIC NOISE IN A WIND TUNNEL Patent
Paul W. Howard and Luke A. Schutzenhofer, inventors (to NASA) Issued 27 Apr. 1976 4 p Filed 26 Aug. 1975 Supersedes N75-3213 4 (13 - 23, p 2880)
(NASA-Case-MFS-23099-1; US-Patent-3,952,590; US-Patent-Appl-SN-607969; US-Patent-Class-73-147) Avail: US Patent Office CSCL 14B

An apparatus is described for reducing the background noise produced by the porous walls of the test section of a wind tunnel. A finely meshed screen member is placed over the perforations in the test section walls. The mesh wire screen attached to the interior wall provides a smoother surface for the air stream to flow against reducing the vorticies produced by the edges of the perforations in the test section walls.
Official Gazette of the U.S. Patent Office

N76-23274 Tennessee Univ., Knoxville.
AN INTEGRAL EQUATION METHOD FOR BOUNDARY INTERFERENCE IN PERFORATED-WALL WIND TUNNELS AT TRANSONIC SPEEDS Ph.D. Thesis
Edward Michael Kraft 1975 133 p
Avail: Univ. Microfilms Order No. 76-11062

The wind tunnel boundary interference at transonic speeds on thin airfoils in two-dimensional perforated-wall wind tunnels is determined. The interference is found by applying integral equation methods to the nonlinear transonic small disturbance equation including embedded supersonic regions with shock waves. The integral equation method for thin airfoils in free air is also examined. It is found that the introduction of a novel influence function yields a self-contained integral equation for lifting airfoils. Solutions for nonlifting airfoils in perforated-wall wind tunnels using the integral method indicate that the wind tunnels can have a profound effect on the shock location on the airfoil. It is demonstrated that the correct shock location as compared to free-air solutions can be obtained by the proper selection of porosity. The porosity required for interference-free testing is shown to be dependent on the Mach number and the airfoil configuration. Dissert. Abstr.

N76-23275 British Library Lending Div., Boston Spa (England).
INSTRUCTIONS ON THE DESIGN OF AERODROME PAVEMENTS
Mar. 1976 80 p Transl. into ENGLISH of "Ukazaniya po Proertirovaniyu Aerodromnykh Pokrytii" Rept. SN-120-70 Literatury po Stroit., Moscow, 1970 p 1-111
(BLL-RTS-9449; SN-120-70) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 20 BLL photocopy coupons

Instructions which apply to the design of aerodrome pavements constructed in U.S.S.R. are presented. J.M.S.

N76-23276*# Stanford Univ., Calif. W. W. Hansen Labs. of Physics.
PERFORM A GYRO TEST OF GENERAL RELATIVITY IN A SATELLITE AND DEVELOP ASSOCIATED CONTROL TECHNOLOGY Annual Report, 1974 - 1975
W. M. Fairbank, C. W. F. Everitt, D. B. DeBra, J. T. Anderson, B. Cabrera, R. R. Clappier, J. A. Lipa, B. Nesbit, F. J. VanKann, and R. A. VanPatten Nov. 1975 47 p Sponsored by NASA
(NASA-CR-147146) Avail: NTIS HC $4.00 CSCL 14B

The progress accomplished in the Stanford Gyro Relativity program during the period November 1974 to October 1975 was described. Gyro developments were continued in the main laboratory dewar, concentrating on the operation of a three axis gyro readout and on improvements to the methods of canceling trapped fields in the rotor; these efforts culminated in the first successful observation of the London moment in the spinning gyro rotor in March 1975. Following a review meeting at that time, a new goal was formulated for the next 12 to 18 months, namely to operate a gyroscope in the new ultra-low field facility with readout resolution approaching 1 arc-second. The following other tasks were also completed: (1) sputtering work, (2) magnetometry, (3) construction and installation of the North Star simulator, (4) analysis of torques on the gyro, especially in inclined orbits, (5) equivalence principle accelerometer, and (6) analysis of a twin-satellite test of relativity. Author

N76-23277# Dynatherm Corp., Cockeysville, Md.
HEATING SYSTEMS FOR AIRPORT PAVEMENT SNOW, SLUSH, AND ICE CONTROL Final Report, 1974 - 1975
M. F. Pravda, D. S. Trimmer, and D. A. Wolf 11 Jul. 1975 144 p refs
(Contract DOT-FA74WA-3421)
(AD-A020757/1; DTM-75-4) Avail: NTIS HC $6.00 CSCL 01/5

Electrical, oil-fired steam, and solar heated pavement systems were investigated. Pavement area sizes ranged from a full runway (1,500,000 sq ft) to a ramp (60,000 sq ft). Both new and existing construction installations were considered. Climates ranged from severe (Juneau, Alaska) to relatively mild (Baltimore, Maryland). Because slush is more disruptive to airport operations than dry snow, and because the pavement heating systems become very expensive to build and operate as the weather climate becomes very severe, Juneau was eliminated from the studies and Chicago, Illinois was substituted in its place. Of the three systems investigated, the capital, total annual, and annual operating costs for an electrically heated runway are the highest. The capital and total annual costs for a steam heated runway are lower than for either the electrical or solar systems. The annual operating cost of the solar system is the lowest for the range of pavement areas represented by runways and ramps. The electrical system is the least efficient and the steam system is the most efficient in the utilization of the Nation's energy resources. For the most part, the solar system does not use the Nation's energy resources. Author

N76-23278# National Bureau of Standards, Washington, D.C.
VALIDATION OF THE DELCAP AIRPORT SIMULATION MODEL Final Report
Judith F. Gilsinn Jul. 1975 167 p
(Contract DOT-FA74WAI-455)
(AD-A021127/6; NBSIR-75-783; FAA-RD-75-154) Avail: NTIS HC $6.75 CSCL 01/5

Airport throughput levels were calculated by DELCAP for five runway configurations, with three or four appropriate operating policies chosen for each, and for three different mixes of aircraft types. These estimates from DELCAP agreed well, generally within 6 to 8 percent, with current values provided by the FAA. An attempt at validating DELCAP's delay-figure output, using existing data on scheduled and actual times of aircraft departures and arrivals, is also reported. It proved unsuccessful, because available

data are not sufficient to isolate that portion of total delay which DELCAP is designed to measure, i.e. terminal area ATC delay. A collection effort to accumulate the necessary data is formulated. Appendices to the report contain program listing, flowcharts, descriptions of program changes from earlier versions, and user instructions for the model's operation. Author

N76-23279# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A SUMMARY OF RUNWAY FRICTION CHANGES DUE TO HIGH-PRESSURE WATER-JET CLEANING OPERATIONS AT FOUR AIRPORTS Final Report, May 1975
Charles Grisel Jan. 1976 17 p refs
(AD-A021684/6; FAA-NA-75-66; FAA-RD-75-218) Avail: NTIS HC $3.50 CSCL 01/5

A new method of removing rubber from concrete runways was evaluated in terms of its effect on runway surface friction. This rubber removal method consisted of jetting water at high velocities to remove the rubber deposits from the surface. The results of the tests indicate that commercial equipment and procedures can be used to remove all the above-the-surface rubber deposits, do not visibly damage the surface, and increase wet runway surface friction in the rubber laden aircraft touchdown areas. Author

N76-23280# California Univ., Livermore. Lawrence Livermore Lab.
VELOCITY MEASUREMENTS OF MYLAR FLYERS USING THE VISAR
N. L. Parker 25 Jul. 1975 19 p refs
(Contract W-740-eng-48)
(UCID-16846) Avail: NTIS HC $4.00

The velocity as a function of time attained by thin Mylar flyers driven down barrels by exploding metal foils was measured by using optical interferometric techniques. Flyer velocities up to 8 mm/microseconds were measured with a velocity interferometer based on the VISAR concept. The acceleration process is found to persist over a relatively long time, corresponding to the flight time of the flyer throughout the whole lenght of the barrel and slightly beyond. Velocity time histories were investigated for different flyer dimensions and a wide range of electrical discharge variables. Author (ERA)

N76-23281# Oak Ridge Y-12 Plant, Tenn.
HIGH TEMPERATURE ELECTRICAL CONDUCTIVITY APPARATUS
J. D. Lore, M. E. Ward, H. L. Richards, and J. H. Stewart, Jr. 1975 15 p refs Presented at the Am. Chem. Soc. Southeastern-Southwestern Regional Meeting, Memphis, 29 Oct. 1975
(Contract W-7405-eng-26)
(Y-DA-6375; Conf-751056-1) Avail: NTIS HC $4.50

The design and application of a high temperature test facility comprising a furnace built in the form of a box where one or more walls are removable to facilitate access to interior components comprising the conductance cell are described. The system is used for measuring the electrical conductivity of slags and molten salts. The bridge circuit for conductance measurements is described. ERA

N76-23282# ARO, Inc., Arnold Air Force Station, Tenn.
CALCULATION OF THE BOUNDARY-LAYER GROWTH IN A LUDWIEG TUBE Final Report, Jul. 1973 - Dec. 1974
James C. Sivells AEDC Dec. 1975 39 p refs
(ARO Proj. VF409; ARO Proj. V37A-32A)
(AD-A018630; ARO-VKF-TR-75-44) Avail: NTIS CSCL 14/2

Experimental boundary-layer measurements obtained in a Ludwieg tube used to drive a pilot transonic tunnel were compared with values calculated by a procedure developed by E. Becker and with those calculated by a method containing several modifications to Becker's method. The modifications fall into three general categories: the use of a skin-friction law and velocity profile exponent which are more accurate at high Reynolds numbers; treatment of the momentum equation as axisymmetric instead of two-dimensional; and calculation at a specified location other than at the origin of the centered expansion wave. GRA

N76-23283# Advisory Group for Aerospace Research and Development, Paris (France).
RANGE INSTRUMENTATION, WEAPONS SYSTEMS TESTING AND RELATED TECHNIQUES
Feb. 1976 362 p refs Partly in ENGLISH and FRENCH
(AGARD-AG-219; AGARDograph-219; ISBN-92-835-0157-8)
Avail: NTIS HC $10.50

Papers are presented which deal with test range instrumentation techniques and systems, test range facilities and requirements. Capabilities, proposed facility improvements, and techniques which have been developed for solving particularly significant problems as well as continuing critical problems are described. Emphasis is placed on weapons systems testing. For individual titles, see N76-23284 through N76-23303.

N76-23284 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
THE EVOLUTION OF TEST RANGES AND THE CHANGING REQUIREMENTS THEY SERVE, AN OVERVIEW
Victor W. Hammond and John W. Bornholdt *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 10 p (For availability see N76-23283 14-09)

The why of test ranges in general is examined along with the trends in test support requirements that have and are continuing to evolve Range Metric Instrumentation Systems. Historical trends in requirements are discussed and compared with the systems and techniques that have evolved over the period considered; that are available and in use; available but not being exploited; and unavailable but readily within the grasp of modern technology. A postulation of tomorrow's test range based on a brief analysis of technology, and the realities of problems--such as inflation, encroachment, and others, is presented. Author

N76-23285 BDM Corp., Albuquerque, N.Mex.
STANDARD PROCEDURES/MEASURES OF EFFECTIVENESS FOR AIR FORCE OPERATIONAL TEST AND EVALUATION (CONSTANT IMPROVEMENT TASK 2)
R. B. Buchanan, J. W. Dyche, W. H. Norris, George Lutz, David P. Vanarsdale, John I. Keener, Donald E. Simon (RCA, Moorestown, N. J.), Milton Heinberg (RCA, Moorestown, N. J.), George Havermahl (RCA, Moorestown, N. J.), John T. Nopanen (RCA, Moorestown, N. J.) et al *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 12 p refs (For availability see N76-23283 14-09)

The broad aspects of operational test and evaluation (OT and E) are reviewed. Certain areas are expanded to illustrate direct application of the principles of standardization for OT and E. Author

N76-23286 White Sands Missile Range, N.Mex. Optics Div.
DISTANT OBJECT ATTITUDE MEASUREMENT SYSTEM (DOAMS)
Lowell Yates *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 15 p refs (For availability see N76-23283 14-09)

A brief history of the development of design criteria for tracking telescopes, including the Distant Object Attitude Measurement System (DOAMS), is presented. Missile attitude, event, and miss-distance data requirements are developed in terms of image content. The optical system modulation transfer function (MTF) is considered to include all known sources of image degradation, i.e., atmospheric turbulence, focus error, image motion, film and optics. Correlation of image content with the MTF demonstrates a technique for the development of telescope performance parameters and their extrapolation into design and test requirements. To record high-resolution images with low distortion at high sampling rates in a desert environment involves two major design problems that are discussed: the development of an athermalized optical system that will maintain precise alignments over a wide range of temperature, and the development of mechanical structures that prevent degradation of the image by camera vibrations and high-acceleration tracking rates. The dual telescope features an f/4, 2,500-mm-focal-length objective with a 360-frame-per-second 70-mm prism camera, and an f/8, 5,000-mm-focal-length objective with a 125-frame-per-second 70-mm pin-registered camera. Author

N76-23287 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.

RADAR DETECTION AND TRACKING IN GROUND CLUTTER c32

R. D. Mitchell, M. R. Paglee, G. M. Sparks, and G. H. Stevens *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 20 p refs (For availability see N76-23283 14-09)

The results are presented of a developmental program designed to provide automatic detection, acquisition, and tracking of high-speed artillery projectiles with an existing C-band precision instrumentation radar. The goals established for the system were detection and acquisition of projectiles with a clutter-to-signal ratio of 30 db, in less than one second after firing; projectiles were to be tracked through the entire trajectory to near impact. The detection process utilized a recursive digital clutter rejection filter and an FFT processor. Tracking was accomplished using multiple-pole fine-line filters in conjunction with clutter guard gates and automatic PRF switching. Preliminary test results indicate detection and tracking of 18 of the 20 projectiles fired in the test. Author

N76-23288 Services Techniques de l'Arme Francaise, Arcueil. Service des Equipements de Champs de Tir.

THE STRADA LANDING TRAJECTOGRAPHY SYSTEM [LE SYSTEME DE TRAJECTOGRAPHIE D'ATTERRISSAGE STRADA]

Christian Giffard and Jean Pierre Marvillet *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 12 p refs In FRENCH (For availability see N76-23283 14-09)

The STRADA system was developed to accurately reconstruct and display, in near-real time, the trajectories of aircraft during approach and landing and thereby allow the development and certification of automatic landing systems. The system utilizes modern electron optics techniques in conjunction with a real-time computer integrated with an observation system; it is based on the LIDAR laser radar system providing the spherical coordinates from a passive optical reflector, which is the only special-purpose hardware that must be installed on the aircraft. The required performance specifications, a general description of the STRADA system a detailed study of its various components, the data reduction techniques, and the role assigned to the computer are described. Resolution of the safety problems associated with the laser system and atmospheric signal propagation was explained, as well as information on projected applications, manning, and cost optimization. Transl. by Y.J.A.

N76-23289 Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex. Test and Evaluation Dept.

THE HITVAL PROGRAM INSTRUMENTATION

Robert L. Chaney *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 8 p (For availability see N76-23283 14-09)

The HITVAL Program, a joint U. S. Army and Air Force test sponsored by the Director of Defense Research and Engineering (DDR&E), was conducted to determine the probability of hit by antiaircraft gun systems firing at fixed-and rotary-wing aircraft. The HITVAL test was one element of a larger program to validate and improve mathematical aircraft attrition models. The HITVAL Program tested five gun systems and produced a large and comprehensive empirical data base from over two thousand gun-aircraft engagements. These data also have possible application to problems of tactics, gun system and crew performance, and training. Instrumentation and techniques developed for the HITVAL Program contributed significantly to the state-of-the-art in the measurement of gun performance parameters and represent advances in resolution, accuracies, and data handling for these and other generic systems and for evaluation test programs. Author

N76-23290 Air Force Armament Lab., Eglin AFB, Fla.

AIRCRAFT/STORES COMPATIBILITY ANALYSIS AND FLIGHT TESTING c05

Charles S. Epstein *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 13 p refs (For availability see N76-23283 14-09)

The state-of-the-art in the field of aircraft/store compatibility testing has been expanded through new photographic, analytic, wind tunnel, and computer techniques. An in-depth explanation of the latest analysis and flight test techniques is given, including the unique marriage of the wind tunnel and the high-speed digital computer in the preflight analysis of data, and the photo-imaging technique of flight test data reduction. Author

N76-23291 Messerschmitt-Boelkow G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.

OPTIMIZATION OF FREE FLIGHT MEASUREMENTS FOR MISSILES c18

L. Stiklorus *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 50 p refs (For availability see N76-23283 14-09)

A series of parameters regarding the performance and the analysis of free flight measurements was investigated to obtain general information about their influence on the accuracy of the aerodynamic stability coefficients to be determined. The findings attained are used to select these parameters in the course of further free flight tests in such a way that optimum results are achieved. Three different missiles were investigated. For two missiles the output data were obtained theoretically by using a digital computer program; for the third free flight measurement data were available. The analysis is based on the Newton-Raphson method, applying the maximum-likelihood principle. For the C sub Z and C sub M coefficients expressions with terms up to the fifth power were considered. In the case of a ballistic missile during the boost phase, the variation of the stability parameter as a function of Mach number, approximated by a polynomial of second power, was determined. In addition, biases of output data and initial values of the state variables were computed in all cases. Author

N76-23292 Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

PROJECTILE AIRBURST AND IMPACT LOCATING SYSTEM (PAILS)

William B. Milway *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 8 p (For availability see N76-23283 14-09)

A system developed to solve the difficult problem of accurately scoring the location of airbursts or impacts from artillery and mortar projectiles is described. Such solutions as acoustics, electro-optics, and radar were analyzed on the basis of reliability, accuracy, cost, utility, and development potential. Selected was a range only radar tri-lateration system operating in the C band. Subsequently, a single prototype radar was fabricated to further explore field implementation of the concept. Field testing of this prototype is now underway with fabrication and application of the complete system to follow successful verification of risk areas. Author

N76-23293 Vega Precision Labs., Inc., Vienna, Va.

A TRACKING AND CONTROL SYSTEM USING PULSED TRANSMISSIONS

Raymond F. Irby *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 16 p refs (For availability see N76-23283 14-09)

Three specific versions of the pulsed tracking and control systems, with the associated vehicle-borne equipment, are described. Principles of operation are discussed. Author

N76-23294 General Dynamics/Electronics, San Diego, Calif.

RMS: A POSITION LOCATION SYSTEM FOR MODERN MILITARY WEAPONS TESTING AND EVALUATION

Willard S. Cushman *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 15 p (For availability see N76-23283 14-09)

The General Dynamics Range Measurement System (RMS) which can track over one thousand targets in real time with accuracies within two meters of true position is described. Author

N76-23295 Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.

AN INTEGRATED TARGET CONTROL SYSTEM

B. W. Bell and R. D. Smith (Naval Air Systems Command) *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 11 p (For availability see N76-23283 14-09)

The ITCS (Integrated Target Control System) which is a modern control system developed, tested, and currently in operational use by the United States Navy is described. The ITCS integrates the C3 (command, control, and communications) functions into a single two-way communication link. Specifically, ITCS transmits commands to the drone, receives telemetry from the drone and provides drone position by tracking in range, azimuth, and elevation. The ITCS is also capable of simultaneous control of multiple drones. The major topics are: (1) background leading to the initiation of the development program, (2) system description including the major components, (3) the employment scenario describing usage of ITCS, (4) a functional description covering pertinent technical details, (5) test programs successfully demonstrating ITCS capabilities, and (6) application of ITCS to major range complexities. Author

N76-23296 Yuma Proving Ground, Ariz.
PRECISION AIRCRAFT TRACKING SYSTEM (PATS)
William W. Steele *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 6 p (For availability see N76-23283 14-09)

An operational laser tracking system for manned aircraft is described and its operating and maintenance characteristics summarized. Data collection and reduction techniques including calibration in real-time and off-line are also described. Laser safety considerations are addressed. An operating cost comparison is made between the laser tracker, conventional cinetheodolites, and semi-automated cinetheodolites on the basis of costs of completely reduced data. Potential future laser tracking applications are discussed with anticipated impact on instrumentation requirements. Author

N76-23297 Air Force Special Weapons Center, Kirtland AFB, N.Mex. Test and Evaluation Systems Program Office.
MINIMAL ERROR TRAJECTORIES ON LINE
Eugene J. Pollock *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 20 p refs (For availability see N76-23283 14-09)

A technique is described for operating instrumentation in a nearly errorless tracking mode to yield correct trajectory on line. This technique uses a polynomial description of the target trajectory to predict target location and overcome time tagging and tracking errors encountered in conventional tracking systems. A fading memory polynomial filter of degree 2 recurrently updates the trajectory estimate from sensor levied displacement errors. Systematic errors of the instrument are identified and eliminated, improving the accuracy of the trajectory data. These errors are evaluated and the instrument calibrated from stellar observations. A highly accurate time base provides network synchronization of trajectory determination. Typical applications as a trajectory measuring instrument and a suitable data source for remotely operated long focal length theodolites are noted. Author

N76-23298 Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
NEAR GROUND TELEMETRY SYSTEMS c17
Horst Kaltschmidt *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 40 p refs (For availability see N76-23283 14-09)

Telemetry systems which are applied in weapons test ranges are reviewed. The basic concept FM, PAM and PCM telemetry is explained including the data storing system in the groundstation. The special properties and effects of modulation concepts and of near ground wave propagation including bord and ground antennas are described. Author

N76-23299 Army Electronic Proving Ground, Fort Huachuca, Ariz. Development Section.
USE OF AUTOMATED SYSTEMS BY THE ELECTROMAGNETIC ENVIRONMENTAL TEST FACILITY IN ELECTROMAGNETIC COMPATIBILITY ANALYSES
Ralph McCluskey *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 9 p refs (For availability see N76-23283 14-09)

Automated electromagnetic compatibility testing of military communications equipment and weapons systems is conducted at the Electromagnetic Environmental Test Facility of the United States Army Electron Proving Ground. The evolutionary progression of electromagnetic compatibility testing from yesterday's costly, time-consuming field-testing process to the automated, rapid-test facilities of today is discussed. Testing methodology and analytical techniques associated with tactical modeling and interference prediction are addressed to provide a comprehensive delineation of the electromagnetic compatibility assessment process. Author

N76-23300 Cubic Corp., San Diego, Calif.
AIR COMBAT MANEUVERING RANGE
Frederic A. Bardshar and George W. Eaton *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 20 p (For availability see N76-23283 14-09)

A new concept in range instrumentation for effective and measured training and analysis of fighter pilots in high performance missile equipped aircraft is described. The air combat maneuvering range (ACMR) instrumentation system analyzes and displays the dynamics of launch platform, missile, and target in a manner permitting accurate recognition of envelope and development of optimized tactics. The ACMR instrumentation system provides markedly improved training effectiveness and economy. Author

N76-23301 Air Force Special Weapons Center, Kirtland AFB, N.Mex. Test and Evaluation Systems Program Office.
DETERMINATION OF INSTRUMENTATION REQUIREMENTS FOR USAF RANGES
June G. Brenton (Dikewood Corp., Albuquerque, N. Mex.), Lawrence J. Smith (Dikewood Corp., Albuquerque, N. Mex.), Terrence G. Wheeler, Richard K. Trask, Jerald D. Miller, James J. Avitabile, and David M. Pearson (General Research Corp., Santa Barbara, Calif.) *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 34 p (For availability see N76-23283 14-09)

In a program to improve the capabilities of USAF ranges, requirements for range instrumentation were determined by the range functions that had to be performed to fulfill the needs of the range users. The ranges are used for operational training and testing. These activities are generally conducted in the context of performing specific missions. Through analysis of the missions, the range functions that will be needed were identified. For the purpose of this analysis, generalized mission descriptions were developed to depict representative combat and support missions of the Air Force. From these descriptions, criteria for evaluating effectiveness of performance during each mission phase were defined. The mission information impacting instrumentation requirements are summarized in ten matrices pertaining to safety, threat, targets, scoring, time-space-position information, command/control/communications, data, facilities/logistics, air/land space, and meteorology. Author

N76-23302 Martin Marietta Aerospace, Orlando, Fla.
MISSILE RADAR GUIDANCE LABORATORY
R. D. Monroe and P. C. Gregory *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 20 p (For availability see N76-23283 14-09)

An improved radar guidance laboratory which allows simultaneous infrared simulation for developing and testing point tracker radar and IR dual mode guidance systems which will be operational in the 1980's is described. These guidance systems will be tested for target acquisition, discrimination, and tracking capabilities under precisely controlled conditions in a dynamic, real-time simulated environment. The radar guidance types can be passive, semi-active or active, covering a frequency range from 0.5 to 18.0 GHz. The IR guidance systems can be passive at 3 to 5 or 8 to 14 microns. A short review of system requirements is furnished, and the major laboratory subsystems are described, with emphasis on the features of the rotational and translation motion systems, anechoic chamber, linear array target antenna system, radar generation system, IR target system, and computation. The principal new design features of this laboratory are the linear array target antenna system and the radar generation system which provides for four distinct radar emitters each of which can simulate simultaneous, independent RF sources. These sources can be surveillance, SAM, search or early warning radars, plus radar returns from illuminated targets, and types of pulsed and continuous wave ECM signals. Phenomena such as atmospheric attenuation, Doppler shift, target cross section deviation, and glint are also simulated. Criteria used to specify the required

system performance, the reasons for criteria selection, and the laboratory test results are also included. Author

N76-23303 BDM Corp., Albuquerque, N.Mex.
ROLE OF SIMULATION IN OPERATIONAL TEST AND EVALUATION
C. P. Semmens, W. H. Norris, and R. B. Buchanan *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 4 p (For availability see N76-23283 14-09)

The OT and E (Operational Test and Evaluation) process is included as an integral part of the system acquisition process, and is the recognized method of measuring and assessing the military utility, operational effectiveness, and operational suitability of proposed systems. The effective use of simulation to reduce cost of OT and E is illustrated. Proper selection, application, and use of simulations increase the productivity of the OT and E process by reducing costs, providing otherwise unattainable data, and offering more timely and valid results. The logic and techniques of simulation application are also applicable to the development process and joint NATO exercises. An example is included of the application of large scale simulation to extend the results of field testing. Author

N76-23211 Royal Radar Establishment, Malvern (England).
SECONDARY RADAR FOR GROUND MOVEMENT CONTROL
Hugh N. Griffiths *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 9 p (For availability see N76-23191 14-04)

N76-23212 Transportation Systems Center, Cambridge, Mass.
ATCRBS TRILATERATION, THE ADVANCED AIRPORT SURFACE TRAFFIC CONTROL SENSOR
J. W. Ogrady, M. J. Moroney, and R. E. Hagerott *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 20 p refs (For availability see N76-23191 14-04)

N76-23213 Service Technique de la Navigation Aerienne, Paris (France).
THE CORAIL SURVEILLANCE SYSTEM FOR AIRPORT RUNWAYS [SYSTEME CORAIL DE SURVEILLANCE DE PISTES D'AEROPORT]
Jean Marc Faysse and Guy Georges Plottin (Laboratoire Central de Telecommunications) *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 18 p In FRENCH and ENGLISH (For availability see N76-23191 14-04)

N76-23216 Linde A.G., Munich (West Germany).
FOG DISPERSAL AT AIRPORTS, THE STATE OF THE ART AND FUTURE TRENDS
W. Baldus, F. V. Melewicz (DOT, Washington, D. C.), A. Pocrnja, K. Ruppert, J. F. Sowar (DOT, Washington, D. C.), and H. Wenzel *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 6 p refs (For availability see N76-23191 14-04)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-23304*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1976
15 Apr. 1976 336 p refs
(Contract NAS7-100)
(NASA-CR-147220; JPL-PR-42-32) Avail: NTIS HC $10.00
CSCL 22D

Progress is reported in flight project support, tracking and data acquisition, research technology, network engineering, hardware and software implementation, and operations. For individual titles, see N76-23305 through N76-23334.

N76-23305* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1976 p 1-13 (For availability see N76-23304 14-12)
CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N76-23306* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS B-DEEP SPACE NETWORK COMPATIBILITY TEST SUMMARY **c14**
A. I. Bryan *In its* The Deep Space Network 15 Apr. 1976 p 14-24 refs (For availability see N76-23304 14-12)
CSCL 14B

The DSN-Helios B-compatibility testing followed a very successful three-phase compatibility test program for the Helios prototype and Helios 1 spacecraft. The tests from arrival of Helios B at Cape Canaveral, Florida through launch are reported. The compatibility tests consisted of (1) DSN-spacecraft radio frequency tests at both weak and strong signal levels, and (2) verification of radio frequency compatibility with the Helios B mated to the launch vehicle at Launch Complex 41. Author

N76-23307* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT **c14**
R. B. Miller *In its* The Deep Space Network 15 Apr. 1976 p 25-30 refs (For availability see N76-23304 14-12)
CSCL 22A

The DSN Master Schedule for preparations for the Pioneer Venus 1978 Orbiter and Multiprobe Mission is described. Author

N76-23308* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT **c14**
P. S. Goodwin, W. G. Meeks, and R. E. Morris *In its* The Deep Space Network 15 Apr. 1976 p 31-37 refs (For availability see N76-23304 14-12)
CSCL 22D

The second Helios spacecraft was successfully launched on January 15, 1976. The trajectory will allow inspection of the solar atmosphere at an unprecedented 0.29 astronomical units (AU) distance from the sun during the Helios-2 perihelion in April 1976. Such a close solar approach will greatly enhance man's knowledge of the inner part of our solar system. The prelaunch and launch activities through the first six days of the Helios-2 mission, as well as cruise status of the Helios-1 spacecraft, are reported. Author

N76-23309* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ATMOSPHERIC WATER VAPOR CALIBRATIONS: RADIOMETER TECHNIQUE **c32**
F. B. Winn, S. C. Wu, G. M. Resch, C. C. Chao, O. H. VonRoos, and H. S. Lau (Stanford Univ.) *In its* The Deep Space Network 15 Apr. 1976 p 38-49 refs (For availability see N76-23304 14-12)
CSCL 20N

A radiometric technique for determining atmospheric water vapor effects on radiometric range and Doppler has been partially evaluated. Empirical test results indicate that the microwave thermal emission from water vapor at 22.2 and 31.4 GHz frequencies can yield line-of-sight electrical phase path calibrations to the centimeter accuracy level. Author

N76-23310* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S- X-BAND EXPERIMENT: DEVELOPMENT AND EVALUATION OF A SET OF GROUP DELAY STANDARDS **c32**
T. Y. Otoshi and R. W. Beatty *In its* The Deep Space Network 15 Apr. 1976 p 50-64 refs (For availability see N76-23304 14-12)
CSCL 17B

Group delay standards of 15, 30, and 60 ns were developed at JPL with advice and consultation from the U.S. National Bureau of Standards (NBS). Calibration data on the delay standards provided by NBS and others are presented and compared. The effects of dispersion and cable reflections are discussed. Calibrations were performed at the S- X-band Experiment frequencies of 2,113, 2,295, and 8,415 MHz as well as at the nominal range-code modulation frequency of 500 kHz. The standards will be useful for checking out the JPL ranging system accuracy in measuring delay changes of about 15 to 60 ns. Author

N76-23311* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPOSED MODIFICATIONS TO THE WIND LOADING SPECIFICATIONS APPLIED TO GROUND ANTENNAS **c39**
M. S. Katow *In its* The Deep Space Network 15 Apr. 1976 p 65-69 refs (For availability see N76-23304 14-12)
CSCL 13M

As the survival wind velocity specification mainly controls the final weight of the reflector structure of a ground antenna, the latest wind data show that the survival specification can be lowered, and therefore the weight can be lowered, from 53.0 m/s (120 mi/h) to less than 44.1 m/s (100 mi/h). The results as based on analysis methods are recommended by the existing design guides. Author

N76-23312* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF COMMAND DETECTOR IN-LOCK MONITORING **c32**
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1976 p 70-73 refs (For availability see N76-23304 14-12)
CSCL 17B

A command detector in-lock monitoring strategy was investigated that uses N estimates of square root of (SNR) each composed of M samples from both data and error channel outputs. The detector recognizes only two states (in-lock and out-of-lock) and indicates state transition when N successive square root of (SNR) estimates violate a threshold. The probabilities are presented of indicating in-lock given the detector is out-of-lock and out-of-lock given in-lock as a function of threshold for (N,M) = (1,10), (2,5), (5,2), (10,1). From these probabilities a threshold compatible with design requirements can be determined. Author

N76-23313* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT EQUIPMENT: RADIO FREQUENCY SECTION **c32**
G. Stevens *In its* The Deep Space Network 15 Apr. 1976 p 74-80 refs (For availability see N76-23304 14-12)
CSCL 17B

The precision signal power measurement (PSPM) equipment was installed at the Goldstone Mars Station, DSS 14. The PSPM equipment features a highly flexible radio frequency (RF) section providing amplification, frequency translation, filtering, sampling and analog to digital (A-D) conversion of the 50 MHz Block 3 Receiver or 55 MHz Block 4 Receiver intermediate frequency (IF) signals. Remote control of gain, tuning and filter selection permits hands-off operation of the RF section of the equipment. The RF section of the PSPM equipment is described. Author

N76-23314* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FOUNDATION ANALYSIS, PRELIMINARY INVESTIGATION **c39**
H. McGinness and M. S. Katow *In its* The Deep Space Network 15 Apr. 1976 p 81-85 ref (For availability see N76-23304 14-12)
CSCL 13M

The known solution of a semi-infinite plate with normal forces on its edge is compared to the computed results of an assembly of solid finite elements in NASTRAN. Author

N76-23315* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POWER SPECTRUM FOR BINARY NRZ DATA WITH LESS THAN 50 PERCENT TRANSITIONS **c17**
B. K. Levitt *In its* The Deep Space Network 15 Apr. 1976 p 86-89 (For availability see N76-23304 14-12)
CSCL 17B

Spacecraft-to-ground telemetry received by the DSN can often be modelled as binary NRZ data with independent transitions of probability p equal to or less than 1/2. A simple expression is derived for the power spectrum of this type of data modulation; this formula is used to investigate how rapidly the data bandwidth decreases as p gets smaller. Author

N76-23316* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT AND NOISE-ADDING RADIOMETER EQUIPMENT **c35**
L. C. Constenla *In its* The Deep Space Network 15 Apr. 1976 p 90-99 refs (For availability see N76-23304 14-12)
CSCL 14B

A new precision signal power measurement equipment incorporating a noise-adding radiometer technique was developed for precise measurement of spacecraft signal power returns. This equipment continuously measures the receiver system noise temperature, signal-to-noise ratio, and received signal power in real time during actual spacecraft tracking. The operation of this system requires that a precisely known amount of noise be switched on and off at the receiver input. This increase in noise is detected and used as a reference in the determination of the receiver system noise temperature. In turn, the system temperature is used to calculate the received signal power. The precision signal power measurement equipment is presently installed in the pedestal room of the DSN 64-m-diameter antenna. The system was successfully tested during the Helios track on 2 October 1975, recording an averaged received carrier power of -140.6 dBm, which was in close agreement with the calibrated automatic gain control method used by the station. Author

N76-23317* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL DEMODULATION WITH A NON-IDEAL QUANTIZER **c32**
J. W. Layland *In its* The Deep Space Network 15 Apr. 1976 p 100-105 refs (For availability see N76-23304 14-12)
CSCL 17B

The use of digital demodulation techniques, or the conversion from analog to digital signal domains before data are demodulated from a radio frequency (RF) carrier, has become increasingly more feasible in recent years as logic circuit speeds increased. This feasibility was demonstrated by use in the Dual-Channel (Mu-II) Sequential Ranging System. Further use is contemplated in the telemetry stream, or integrated into the phase-tracking receiver. Some of the properties which must be considered in the analog-to-digital (A-D) converter to be used in these applications are presented. In particular, the loss to be expected with an A-D unit built from current circuitry is calculated. Author

N76-23318* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WAVEFRONT STIFFNESS MATRIX RESEQUENCING PROGRAM MODIFICATIONS FOR THE 1108 COMPUTER **c39**
R. Levy *In its* The Deep Space Network 15 Apr. 1976 p 106-109 refs (For availability see N76-23304 14-12)
CSCL 13M

WAVEFRONT is a preprocessor computer program that provides resequencing to expedite decomposition of the structural stiffness matrix within the NASTRAN analysis system. Modifications described improve WAVEFRONT by reducing core requirements, speeding the execution, and extending the acceptable categories for input data. Author

N76-23319* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ANALYSIS OF MICROWAVE WEATHER PROJECT DATA **c17**
M. S. Reid *In its* The Deep Space Network 15 Apr. 1976 p 110-117 refs (For availability see N76-23304 14-12)
CSCL 17B

The Microwave Weather Project forms part of an overall Radio Systems Development Project which seeks to optimize the spacecraft-to-ground communications link. Statistical correlations of weather and communications capability at X- and K-bands are needed to provide practical statistical prediction of the performance of the Deep Space Network at X-band and, in the future, at K-band. A previous article discussed the general approach of the project, the measurements, calibrations, equipment, and methods. The results of the Weather Project for 1971 through 1974 are summarized. Computed results of increases in system temperature due to atmospheric effects are plotted as functions of time, frequency, elevation angle, etc. Comparisons are made with theoretical predictions derived from a contractor report submitted to JPL, which calculated signal attenuation due to cloud cover from meteorological measurements. Author

N76-23320* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X-BAND REJECT FILTER **c33**
R. Lay *In its* The Deep Space Network 15 Apr. 1976 p 118-122 refs (For availability see N76-23304 14-12)
CSCL 09C

In support of an effort to isolate any receive band components of transmitter noise being received at the X-band maser, a one-cavity band reject filter was fabricated and tested. The goal was to develop a series of cavity band reject filters capable of providing a rejection of 100 db in the passband of the receiver.
Author

N76-23321* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO METHODS FOR REDUCING THE NUMBER OF MULTIPLICATIONS IN COMPLEX FAST FOURIER TRANSFORMS **c64**
D. E. Wallis *In its* The Deep Space Network 15 Apr. 1976 p 123-138 refs (For availability see N76-23304 14-12)
CSCL 12A

Computational savings in hardware and software mechanizations of the Fast Fourier Transform (FFT) are obtained by two methods: the first method, generalizable for N a power of 2, exploits the intrinsic simplicity of multiplication by j (unit imaginary), in addition to the periodicity and half-period negation identities usually employed. The second method, outlined for the case N = 16 only, exploits the quadrantal symmetries of the real cosine and sine functions in an implementation of the complex FFT which uses only real multiplications. The first method requires $N/2 \log_2 N/8 + 2$ nontrivial complex multiplications, or 10 complex multiplications at N = 16. The second method requires only 12 real-coefficient multiplications at N = 16 to achieve the same results, but a generalization to higher N is not presently known.
Author

N76-23322* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATED TRACKING SYSTEM FOR THE ARIES ANTENNA **c17**
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1976 p 139-150 (For availability see N76-23304 14-12)
CSCL 17I

A miniprocessor-based tracking system was developed for the Astronomical Radio Interferometric Earth Surveying (ARIES) antenna. The system is a servo loop in which tracking errors and correction commands are calculated in software.
Author

N76-23323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN INTEL 8080 CROSS ASSEMBLER FOR THE MODCOMP 2 MINICOMPUTER **c60**
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1976 p 151-163 (For availability see N76-23304 14-12)
CSCL 09B

The flexibility of MODCOMP'S macro assembler was exploited to implement an INTEL 8080 cross assembler. This simple implementation is very powerful, allowing, for example, macro definitions, and declaration of common and external labels. The cross assembler may be executed on any MODCOMP 2 minicomputer.
Author

N76-23324* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THEORY, OPERATION, AND COMPUTER PROGRAMMING OF THE 512-LAG CORRELATOR SYSTEM **c61**
R. F. Jurgens *In its* The Deep Space Network 15 Apr. 1976 p 164-177 refs (For availability see N76-23304 14-12)
CSCL 09B

The theory, operation, and computer programming of the JPL-Haystack autocrosscorrelator system are described. This system provides 512 channels with a basic bandwidth of 10 MHz and has provisions for multilevel sampling, oversampling, and bandwidth multiplication by factors of 2 and 4. The system controller features automatic word extension to 40 bits, precise control of the zero lag counter, and computer-enabled run or start commands.
Author

N76-23325* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ANALYSIS OF STRUCTURED PROGRAMS. PART 1: KIRCHHOFF'S EQUATIONS **c61**
R. J. McEliece *In its* The Deep Space Network 15 Apr. 1976 p 178-187 refs (For availability see N76-23304 14-12)
CSCL 09B

It is shown that the analysis of a structured computer program is in some ways much easier than the analysis of unstructured ones. This is in contrast to the usual argument, which is that the synthesis of a structured program is easier than an unstructured one.
Author

N76-23326* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW CLASS OF BURST-CORRECTING CYCLIC CODES **c61**
B. Arazi *In its* The Deep Space Network 15 Apr. 1976 p 188-200 ref (For availability see N76-23304 14-12)
CSCL 09B

In many DSN communication systems (the GCF, computer-computer data transfer, etc.) transmission errors tend to occur in intermittent bursts. A new class of burst-error-correcting codes, potentially applicable to DSN systems, is described. Many of these codes are superior to any previously known.
Author

N76-23327* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ERROR-MINIMIZING SOFTWARE AUDIT TECHNIQUE **c61**
J. C. Holland and W. O. Paine *In its* The Deep Space Network 15 Apr. 1976 p 201-221 ref (For availability see N76-23304 14-12)
CSCL 09B

A method is presented for systematizing a software code-design audit, using principles of set theory to delineate, with a minimum of effort and a maximum of error-detecting capability, the various individual discrepancies present in the software.
Author

N76-23328* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY RESULTS OF DSN PERFORMANCE FOR CONVOLUTIONAL CODES WITH A VITERBI DECODER **c61**
J. M. Urech, L. D. Vit, and B. D. L. Mulhall *In its* The Deep Space Network 15 Apr. 1976 p 222-240 refs (For availability see N76-23304 14-12)
CSCL 09B

To determine DSN Telemetry System performance when maximum-likelihood convolutional decoding is employed, testing is being undertaken at DSS 62, Madrid, Spain. Testing hardware and software were developed to evaluate the performance of the DSN in the Viterbi mode with the LV7015 model. Since the bit errors at the decoder output occur in bursts, the test program includes a series of statistical analyses in runs of correct bits and bursts of bits in error.
Author

N76-23329* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHASE-STABLE RECEIVER DEVELOPMENT **c32**
C. E. Johns *In its* The Deep Space Network 15 Apr. 1976 p 241-246 refs (For availability see N76-23304 14-12)
CSCL 17B

Physical changes in coaxial cable parameters cause corresponding phase variations to RF signals being transmitted through them. In some types of receivers these variations directly affect the information signal. A phase-correcting circuit was developed which greatly reduces the cable effects upon an RF signal. Two types of correcting loops and test results from breadboard units are described.
Author

N76-23330* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER MODELING OF A SINGLE-STAGE LITHIUM BROMIDE/WATER ABSORPTION REFRIGERATION UNIT **c44**
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1976 p 247-257 refs (For availability see N76-23304 14-12)
CSCL 10B

Solar-assisted refrigeration systems were proposed for application in the Goldstone energy conservation projects. The dynamic simulation and the computer modeling procedure of one of these systems are described, namely a lithium bromide/water absorption refrigeration system. A new analytical expression that fits the three-dimensional surface of LiBr concentration, refrigerant temperature and solution temperature in the range of interest from 0.50 to 0.65 kg LiBr/kg solution is presented with a standard deviation of + or - 0.2 percent. This will save considerable computing time and effort required for evaluation of system performance. A numerical example from typical running conditions is added to show the relative weight of each parameter used together with the sequence of program steps followed.

The results from this simulation are heat rates, line concentrations, pressures and the overall coefficient of performance.
Author

N76-23331* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT c14
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1976 p 258-261 (For availability see N76-23304 14-12)
CSCL 14B

The activities at the Goldstone Venus Station (DSS 13) and the Microwave Test Facility (MTF), during the period Dec. 8, 1975 through Feb. 15, 1976, are discussed and progress noted. Continuing testing and refinement of the remote controlled automated pulsar observing station is noted, along with routine pulsar observations of 22 pulsars. Automatic stability-reliability testing of the station receiver/maser noise-adding radiometer (NAR) combination is described. An updated discussion of the data being collected by the 24-hour-per-day, seven-day-per-week Solar and Microwave Data Acquisition System (SAMDAS) is presented in which currently available data types are tabulated. Supporting research activities in support of the X-band radar and stability tests on semirigid coaxial cables are discussed along with preparations for testing of a new design diplexer for future DSN use. The activities of the DSN High-Power Transmitter Maintenance Facility are discussed, and continuing observations of Jupiter at 2,295 MHz are reported along with the radio calibration sources used in this program. Routine clock synchronization transmissions are noted along with some engineering measurements and changes directed toward energy conservation.
Author

N76-23332* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF SOLAR EFFECTS UPON OBSERVED DOPPLER NOISE DURING THE HELIOS 1 SECOND SOLAR CONJUNCTION c17
A. L. Berman *In its* The Deep Space Network 15 Apr. 1975 p 262-276 refs (For availability see N76-23304 14-12)
CSCL 17B

Observed Doppler noise during the Helios 1 second solar conjunction is analyzed with the previously presented NOISE solar noise model. It is concluded that the NOISE model continues to adequately predict average solar corruption of observed Doppler noise, and that deviations from the NOISE model continue to appear to correlate in some fashion with fluctuations in observed solar activity.
Author

N76-23333* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE HELIOS 2 LAUNCH PHASE c17
L. E. Bright *In its* The Deep Space Network 15 Apr. 1976 p 277-295 (For availability see N76-23304 14-12)
CSCL 22D

The prelaunch planning for the DSN's participation in the launch of the Helios 2 spacecraft is reviewed from the point of view of the tracking function. The actual events of the initial acquisition are discussed and analyzed in relation to prelaunch plans. In addition, an analysis of the effects of the Helios 2 spacecraft's spin on Doppler data is provided.
Author

N76-23334* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE EFFECTS ON TRANSMISSION LINE PHASE AND GROUP DELAY c32
H. R. Buchanan and A. L. Price *In its* The Deep Space Network 15 Apr. 1976 p 296-300 refs (For availability see N76-23304 14-12)
CSCL 17B

The phase and group delay stability was investigated for various coaxial and waveguide transmission lines. The purpose of the test is to determine the feasibility of separating the receiver-exciter equipment from the tricone area of the 64-meter antenna. Initial test results are reported from both controlled environment and field operating environment experiments.
Author

N76-23335*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT GUIDANCE AND CONTROL SYSTEMS: PRIMARY GUIDANCE, NAVIGATION, AND CONTROL SYSTEM DEVELOPMENT
M. D. Holley, W. L. Swingle, S. L. Bachman, C. J. LeBlanc, H. T. Howard, and H. M. Biggs Washington May 1976 71 p (NASA-TN-D-8227; S-453) Avail: NTIS HC $4.50 CSCL 22A

The primary guidance, navigation, and control systems for both the lunar module and the command module are described. Development of the Apollo primary guidance systems is traced from adaptation of the Polaris Mark II system through evolution from Block I to Block II configurations; the discussion includes design concepts used, test and qualification programs performed, and major problems encountered. The major subsystems (inertial, computer, and optical) are covered. Separate sections on the inertial components (gyroscopes and accelerometers) are presented because these components represent a major contribution to the success of the primary guidance, navigation, and control system.
Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-23336*# George Washington Univ., Washington, D.C.
STABILITY AND RELATIVE STABILITY OF LINEAR SYSTEMS WITH MANY CONSTANT TIME DELAYS Ph.D. Thesis
Larry Keith Barker 9 May 1976 108 p refs Sponsored by NASA
(NASA-CR-147918) Avail: NTIS HC $5.50 CSCL 22C

A method of determining the stability of linear systems with many constant time delays is developed. This technique, an extension of the tau-decomposition method, is used to examine not only the stability but also the relative stability of retarded systems with many delays and a class of neutral equations with one delay. Analytical equations are derived for partitioning the delay space of a retarded system with two time delays. The stability of the system in each of the regions defined by the partitioning curves in the parameter plane is determined using the extended tau-decomposition method. In addition, relative stability boundaries are defined using the extended tau-decompositon method in association with parameter plane techniques. Several applications of the extended tau-decomposition method are presented and compared with stability results obtained from other analyses. In all cases the results obtained using the method outlined herein coincide with and extend those of previous investigations. The extended tau-decomposition method applied to systems with time delays requires less computational effort and yields more complete stability analyses than previous techniques.
Author

N76-24121* Harvard Coll. Observatory, Cambridge, Mass. Center for Astrophysics.
AN ALTERNATIVE OPTION TO THE DUAL-PROBE OUT-OF-ECLIPTIC MISSION VIA JUPITER SWINGBY
G. Colombo, D. A. Lautman, and G. Pettengill (MIT) *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 37-47 refs (For availability see N76-24119 14-92)
CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N76-23305* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1976

p 1-13 (For availability see N76-23304 14-12)
CSCL 14B

N76-23306* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS B-DEEP SPACE NETWORK COMPATIBILITY TEST SUMMARY
A. I. Bryan *In its* The Deep Space Network 15 Apr. 1976 p 14-24 refs (For availability see N76-23304 14-12)
CSCL 14B

N76-23307* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Apr. 1976 p 25-30 refs (For availability see N76-23304 14-12)
CSCL 22A

N76-23308* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. G. Meeks, and R. E. Morris *In its* The Deep Space Network 15 Apr. 1976 p 31-37 refs (For availability see N76-23304 14-12)
CSCL 22D

N76-23331* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1976 p 258-261 (For availability see N76-23304 14-12)
CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-23337*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEMS AND ROUTES TO A SOLUTION FOR TEMPERATURE CONTROL IN HIGH-POWER COMMUNICATIONS SATELLITES
U. Hoppe and J. Lorschiedter Washington NASA May 1976 41 p refs Transl. into ENGLISH from the German Report DGLR-Paper-73-052 Presented at the DGLR Symp. Nachrichtensatelliten, Stuttgart, 16-17 May 1973
(Contract NASw-2791)
(NASA-TT-F-17021; DGLR-Paper-73-052) Avail: NTIS HC $4.00 CSCL 22B

A survey of systems which can be used for communications satellite temperature control is presented. The systems discussed are louvers, heat pipes, radiators, latent heat storage, surface coatings, and insulation. These systems are demonstrated by means of a direct TV broadcasting satellite. Author

N76-23227 Department of Transport, Ottawa (Ontario).
AERONAUTICAL SATELLITE SYSTEM (AEROSAT)
J. Ruden and J. Thomas *In* AGARD Plans and Develop. for Air Traffic Systems Feb. 1976 10 p (For availability see N76-23191 14-04)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N76-23338*# Battelle Columbus Labs., Ohio.
PHASE 2 STS NEW USER DEVELOPMENT PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report
J. R. McDowell 26 Mar. 1976 44 p refs 5 Vol.
(Contract NAS8-31621)
(NASA-CR-144295) Avail: NTIS HC $4.00 CSCL 22A

A methodology for developing new users for STS other than NASA and DoD, thereby maximizing the use of the STS system was developed. The approach to user development, reflected in the implementation plan, and attendant informational material to be used were evaluated by conducting a series of test cases with selected user organizations. These test case organizations were, in effect, used as consultants to evaluate the effectiveness, the needs, the completeness, and the adequacy of the user development approach and informational material. The selection of the test cases provided a variety of potential STS users covering industry, other government agencies, and the educational sector. The test cases covered various use areas and provided a mix of user organization types. A summary of the actual test cases conducted is given. The conduct of the test cases verified the general approach of the implementation plan, the validity of the user development strategy prepared for each test case organization and the effectiveness of the STS basic and user customized informational material. Author

N76-23339*# Battelle Columbus Labs., Ohio.
PHASE 2 STS NEW USER DEVELOPMENT PROGRAM. VOLUME 2: NARRATIVE REPORT Final Report
J. R. McDowell 18 Mar. 1976 156 p refs 5 Vol.
(Contract NAS8-31621)
(NASA-CR-144296) Avail: NTIS HC $6.75 CSCL 22A
For abstract, see N76-23338.

N76-23340*# Battelle Columbus Labs., Ohio.
PHASE 2 STS NEW USER DEVELOPMENT PROGRAM. VOLUME 3: THE IMPLEMENTATION PLAN Final Report
J. R. McDowell 24 Mar. 1976 54 p refs 5 Vol.
(Contract NAS8-31621)
(NASA-CR-144297) Avail: NTIS HC $4.50 CSCL 22A
For abstract, see N76-23338.

N76-23341*# Battelle Columbus Labs., Ohio.
PHASE 2 STS NEW USER DEVELOPMENT PROGRAM. VOLUME 4: GUIDANCE/INSTRUCTIONS FOR REPRESENTATIVES Final Report
J. R. McDowell 24 Mar. 1976 20 p refs 5 Vol.
(Contract NAS8-31621)
(NASA-CR-144298) Avail: NTIS HC $3.50 CSCL 22A

The overall STS New User Development (NUD) Function is shown. The user development function is directly responsible for implementing the strategy derived to develop a specific, prospective new user. The burden of actually developing the user falls on the NUD representative, and the success of his user contacts will depend upon how well he is prepared to interface with the user. The guidance/instructions as to what a NUD representative needs to know about the prospective user, and the type of data he should provide when calling on a potential user, are presented. Author

N76-23342*# Battelle Columbus Labs., Ohio.
PHASE 2 STS NEW USER DEVELOPMENT PROGRAM. VOLUME 5: INFORMATIONAL MATERIALS Final Report
J. R. McDowell 24 Mar. 1976 15 p refs 5 Vol.
(Contract NAS8-31621)
(NASA-CR-144299) Avail: NTIS HC $3.50 CSCL 22A

The informational material which should be provided to the user is described. Recommendations are made as to how the informational material should be derived and maintained, the timeliness or phasing of its use, and the applicability of existing informational material. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-23343 Denver Univ., Colo.
A METHOD OF OPTIMIZING THE REPORTING MODE OF

CONSTRAINED REMOTE TELEMETRY SYSTEMS Ph.D. Thesis
Thomas Layne Livingston 1975 134 p
Avail. Univ. Microfilms Order No. 76-10291

Generalized expressions for modeling a telemetry system are formulated, and the critical parameters in the representations are asserted and defined. Expressions are developed for determining communications performance, reporting performance, and reporting efficiency as a function of the mode of reporting the data. Markov representations of the interrogated and dual reporting process provide a convenient means for determining the expected number of interrogations required to successfully accomplish a data report. The transmission format incorporated in the theoretical model permits maximum flexibility in adapting it to a variety of systems. As a result of the generalized format, the relative effects of different encoding schemes upon the communications performance can be analyzed. The optimization method's utility and adaptability for practical applications is demonstrated for an ocean buoy system that telemeters environmental data via the synchronous GOES satellite.
Dissert. Abstr.

N76-23344# Sandia Labs., Albuquerque, N.Mex.
TELEMETRY LINK FOR AN EARTH PENETRATOR
T. W. H. Caffey 1974 10 p refs Presented at the Intern. Telemetering Conf., New Carrollton, Md., 14 Oct. 1975 Sponsored by ERDA
(SAND-75-5431; Conf-751003-2) Avail: NTIS HC $4.00

The design and field testing of a telemetry link to send signals to the surface of the earth from an earth penetrator are described. The link uses a PCM/FM format at a frequency of 10.5 kHz, dissipates 8 watts, and fits within a cylinder with an inside diameter of 100 mm. A bit error rate of less than 0.00001 was achieved from a depth of 52 meters at a bit rate of 1,000 bits per second.
Author (ERA)

N76-23298 Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
NEAR GROUND TELEMETRY SYSTEMS
Horst Kaltschmidt *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 40 p refs (For availability see N76-23283 14-09)

N76-23315* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POWER SPECTRUM FOR BINARY NRZ DATA WITH LESS THAN 50 PERCENT TRANSITIONS
B. K. Levitt *In its* The Deep Space Network 15 Apr. 1976 p 86-89 (For availability see N76-23304 14-12)
CSCL 17B

N76-23319* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ANALYSIS OF MICROWAVE WEATHER PROJECT DATA
M. S. Reid *In its* The Deep Space Network 15 Apr. 1976 p 110-117 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23322* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATED TRACKING SYSTEM FOR THE ARIES ANTENNA
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1976 p 139-150 (For availability see N76-23304 14-12)
CSCL 17I

N76-23332* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF SOLAR EFFECTS UPON OBSERVED DOPPLER NOISE DURING THE HELIOS 1 SECOND SOLAR CONJUNCTION
A. L. Berman *In its* The Deep Space Network 15 Apr. 1975 p 262-276 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23333* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE HELIOS 2 LAUNCH PHASE
L. E. Bright *In its* The Deep Space Network 15 Apr. 1976 p 277-295 (For availability see N76-23304 14-12)
CSCL 22D

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-23345*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF PHASE CHANGE PAINT TESTS OF 0.040 SCALE 50% FOREBODY MODELS (82-0) OF THE SPACE SHUTTLE ORBITER IN THE AEDC VKF B HYPERSONIC WIND TUNNEL (OH75)
W. H. Dye (Rockwell Intern., Downey, Calif.) Apr. 1976 32 p refs
(Contract NAS9-13247)
(NASA-CR-144618; DMS-DR-2303) Avail: NTIS HC $4.00 CSCL 22B

Post-test information and data are presented from phase change paint, aerodynamic heating wind tunnel tests of a Rockwell International space shuttle orbiter forebody model. These tests were conducted in the Arnold Engineering and Development Center von Karman Facility Tunnel B Hypersonic Wind Tunnel. The purpose of these tests was to determine the effect of simulated orbiter protuberances and penetrations (including RCS nozzles) on aerodynamic heating rates during simulated entry conditions.
Author

N76-23346*# Martin Marietta Corp., Denver, Colo.
SPACE TUG THERMAL CONTROL FOLLOW-ON Final Report
Terry L. Ward Oct. 1975 312 p refs
(Contract NAS8-30746)
(NASA-CR-144029; MCR-75-270) Avail: NTIS HC $9.75 CSCL 22B

The Space Tug Thermal Control Follow-On program was conducted to further explore some of the thermal control concepts proposed for use in space tug in a breadboard test program. The objectives were to demonstrate the thermal control capabilities of a louver/battery configuration and a thermal conditioning panel/heat pipe radiator configuration. An additional objective was added to model the header pipe and radiator of the second test and correlate the analysis with the test results. These three objectives were achieved and are discussed within this report.
Author

N76-23347*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
ANALYSIS OF PAYLOAD BAY MAGNETIC FIELDS DUE TO dc POWER MULTIPOINT AND SINGLE POINT GROUND CONFIGURATIONS Space Shuttle Engineering and Operations Support
R. M. Lawton 28 Apr. 1976 19 p refs
(Contract NAS9-14960)
(NASA-CR-147703; Rept-1.3-DN-C0504-030) Avail: NTIS HC $3.50 CSCL 22B

An analysis of magnetic fields in the Orbiter Payload Bay resulting from the present grounding configuration (structure return) was presented and the amount of improvement that would result from installing wire returns for the three dc power buses was determined. Ac and dc magnetic fields at five points in a cross-section of the bay are calculated for both grounding configurations. Y and Z components of the field at each point are derived in terms of a constant coefficient and the current amplitude of each bus. The dc loads assumed are 100 Amperes for each bus. The ac noise current used is a spectrum 6 db higher than the Orbiter equipment limit for narrowband conducted emissions. It was concluded that installing return wiring to provide a single point ground for the dc Buses in the Payload Bay would reduce the ac and dc magnetic field intensity by approximately 30 db.
Author

N76-23348# Alabama Univ., University. Bureau of Engineering Research.
OPTIMUM ATTITUDE CONTROL OF FLEXIBLE BODIES

Final Report
J. L. Hill, H. B. Wilson, and D. J. Herron Jun. 1975 70 p
(Contract DAAH01-74-C-0833)
(AD-A018464; BER-191-100) Avail: NTIS CSCL 19/7

Although the major development work on VSR (Vibration of a Spinning Rocket) was previously done, further refinements were made in VSR under this project and the program was used to analyze case studies pertinent to the parameters of interest. A definition of the current capabilities of VSR and its applicability to this project is included. GRA

N76-23291 Messerschmitt-Boelkow G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
OPTIMIZATION OF FREE FLIGHT MEASUREMENTS FOR MISSILES
L. Stiklorus *In* AGARD Range Instrumentation, Weapons Systems Testing and Related Techniques Feb. 1976 50 p refs (For availability see N76-23283 14-09)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-23349*# TRW Systems Group, Redondo Beach, Calif.
ZERO-G FLIGHT TEST OF A GAUGING SYSTEM. VOLUME 1: SUMMARY
Jan. 1976 92 p refs
(Contract NAS9-14349)
(NASA-CR-147706; TRW-26960-6001-TU-00-Vol-1) Avail: NTIS HC $5.00 CSCL 14B

The capability of a nucleonic gauging system to gauge the content of a reduced-scale storable liquid tank in a zero-g environment as provided by a KC-135 Zero-G Aircraft was demonstrated. Although the propellant-ullage interface never achieved the stable, zero-g equilibrium configuration, the gauging system gauged liquid quantity over all tank loadings to a total system accuracy the order of two percent. It was also determined that the gauging system presented no undue safety hazard to operating personnel in either ground and/or flight testing.Author

N76-23350*# TRW Systems Group, Redondo Beach, Calif.
ZERO-G FLIGHT TEST OF A GAUGING SYSTEM. VOLUME 2: SYSTEM SOFTWARE
Jan. 1976 83 p
(Contract NAS9-14349)
(NASA-CR-147707; TRW-26960-6001-TU-00-Vol-2) Avail: NTIS HC $5.00 CSCL 14B

The nucleonic gauging system software for the computation of propellant mass is described. Author

N76-23351*# Scientific Translation Service, Santa Barbara, Calif.
THE ORBITAL INFRARED TELESCOPE-SPECTROMETER OF THE MANNED STATION 'SALYUT-4'
M. N. Markov, V. S. Petrov, Yu. S. Ivanov, V. Yu. Modenov, and V. K. Surovov Washington NASA May 1976 16 p refs Transl. into ENGLISH from USSR Acad. of Sci. of the Order of Lenin (Moscow), preprint no. 148, 1975 p 1-19
(Contract NASw-2791)
(NASA-TT-F-17014; Preprint-148) Avail: NTIS HC $3.50 CSCL 14B

The telescope-spectrometer developed for the range of 1-8 microns is discussed, together with its three assemblies: scanning infrared spectrometer, observation and motion-picture camera assembly, and control panel. Author

N76-23352*# IBM Federal Systems Div., Houston, Texas.
SPACE SHUTTLE ORBITER AVIONICS SOFTWARE. SYSTEMS ANALYSIS FLIGHT SOFTWARE AND SDL ANALYSIS REPORTS
31 Oct. 1975 169 p refs
(Contract NAS9-14444)
(NASA-CR-147717; Rept-75-SS-0840) Avail: NTIS HC $6.75 CSCL 22B

Results are presented of systems analyses of the avionics software of the space shuttle orbiter. J.M.S.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-23353 Wayne State Univ., Detroit, Mich.
ROCKET EXHAUST PLUMES AND EXPLOSIVE RELEASES IN THE UPPER ATMOSPHERE Ph.D. Thesis
Frederick Perry Boynton 1975 164 p
Avail: Univ. Microfilms Order No. 76-10920

The explosive release of a gas mixture in the atmosphere is examined as a means of simulating the mixing region of an exhaust plume. Conditions for exact equivalence between the two flows are difficult to achieve. In order to determine how closely conditions in an axially-symmetric plume can be reproduced by a spherically-symmetric release, detailed calculations of conditions and particle histories in the two flows are carried out and compared. Plume calculations are performed using a previously developed code release calculations are performed using newly developed time-dependent Lagrangian code. Transport processes (including multicomponent diffusion) are included in both calculations. The results indicate that, despite differences in geometry and the relatively low-exit-plane Mach numbers of typical plumes, a fairly close match to streamline density and temperature histories in the plume can be achieved in the release.
Dissert. Abstr.

N76-23354*# Auburn Univ., Ala.
SOLID-PROPELLANT ROCKET MOTOR BALLISTIC PERFORMANCE VARIATION ANALYSES Final Report
Richard H. Sforzini and Winfred A. Foster, Jr. Oct. 1975 197 p
(Contract NCA8-00106)
(NASA-CR-144264) Avail: NTIS HC $7.50 CSCL 21H

Results are presented of research aimed at improving the assessment of off-nominal internal ballistic performance including tailoff and thrust imbalance of two large solid-rocket motors (SRMs) firing in parallel. Previous analyses using the Monte Carlo technique were refined to permit evaluation of the effects of radial and circumferential propellant temperature gradients. Sample evaluations of the effect of the temperature gradients are presented. A separate theoretical investigation of the effect of strain rate on the burning rate of propellant indicates that the thermoelastic coupling may cause substantial variations in burning rate during highly transient operating conditions. The Monte Carlo approach was also modified to permit the effects on performance of variation in the characteristics between lots of propellants and other materials to be evaluated. This permits the variabilities for the total SRM population to be determined. A sample case shows, however, that the effect of these between-lot variations on thrust imbalances within pairs of SRMs is minor in compariosn to the effect of the within-lot variations. The revised Monte Carlo and design analysis computer programs along with instructions including format requirements for preparation of input data and illustrative examples are presented. Author

N76-23355*# Hughes Research Labs., Malibu, Calif.
THRUSTER ENDURANCE TEST Final Report
C. Collett May 1976 276 p refs
(Contracts NAS3-15523; NAS3-17803)
(NASA-CR-135011) Avail: NTIS HC $9.25 CSCL 21C

A test system was built and several short term tests were completed. The test system included, in addition to the 30-cm ion thruster, a console for powering the thruster and monitoring performance, a vacuum facility for simulating a space environment, and a storage and feed system for the thruster propellant. This system was used to perform three short term tests (one 100-hour

and two 500-hour tests), an 1108-hour endurance test which was aborted by a vacuum facility failure, and finally the 10,000-hour endurance test. In addition to the two 400 series thrusters which were used in the short term and 1100-hour tests, four more 400 series thrusters were fabricated, checked out, and delivered to NASA. Three consoles similar to the one used in the test program were also fabricated and delivered.
Author

N76-23356*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
THE ION-OPTICS OF A TWO-GRID ELECTRON-BOMBARDMENT THRUSTER M.S. Thesis
Graeme Aston May 1976 80 p refs
(Grant NGR-06-002-112)
(NASA-CR-135034) Avail: NTIS HC $5.00 CSCL 21C

A detailed experimental investigation was performed to determine the ion-optical performance of an electron-bombardment ion thruster as a function of grid geometry changes. The results show that each geometrical grid parameter independently affects one aspect of ion-optical performance. These observations are used in developing a graphical technique to predict the ion-optical performance of an arbitrary ion source and grid geometry combination. The usefulness of this technique is demonstrated by comparing predicted ion-optical performance of the 30-cm diameter engineering model ion thruster with independent experimental determinations. Good agreement is shown between predicted and experimental results. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-23357 British Library Lending Div., Boston Spa (England).
STABILIZATION OF AROMATIC POLYAMIDES TO UV LIGHT SYSTEMATIC SYNTHESIS OF STABILIZERS
B. Kuester and H. Herlinger Apr. 1975 12 p refs Transl. into ENGLISH from Angen. Makromolekulare Chem. (West Ger.), vol. 40/41, no. 608, 1974 p 265-276
(BLL-DRIC-Trans-4102-(3623.66); BR45183) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The photolytic degradation of poly-m-phenylene isophthal amide and its structural elements is treated. It is shown that the photoanilide rearrangement and its related side reactions are detrimental for the polymer. The prevention of the degradation of the polymer by application of systematically synthesized stabilizers as 2-(2'-hydroxy-5'-tert-butyl phenyl)-benzo triazol-5-carbonic acid anilide is treated. The theory of light filter mechanism and mechanisms of energy transfer are discussed. A mechanism of energy dissipation of benzo triazole stabilizers is introduced.
Author

24 COMPOSITE MATERIALS

Includes laminates.

N76-23358*# Acurex Corp., Mountain View, Calif. Aerotherm Div.
FOAM COMPOSITE STRUCTURES Final Report
Chadwick B. Delano and Robert J. Milligan Mar. 1976 58 p ref
(Contract NAS2-8189)
(NASA-CR-137834; Aerotherm-76-193) Avail: NTIS HC $4.50 CSCL 11D

The need to include fire resistant foams into state of the art aircraft interior paneling to increase passenger safety in aircraft fires was studied. Present efforts were directed toward mechanical and fire testing of panels with foam inclusions. Skinned foam filled honeycomb and PBI structural foams were the two constructions investigated with attention being directed toward weight/performance/cost trade-off. All of the new panels demonstrated improved performance in fire and some were lighter weight but not as strong as the presently used paneling. Continued efforts should result in improved paneling for passenger safety. In particular the simple partial filling (fire side) of state-of-the-art honeycomb with fire resistant foams with little sacrifice in weight would result in panels with increased fire resistance. More important may be the retarded rate of toxic gas evolution in the fire due to the protection of the honeycomb by the foam.
Author

N76-23359*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL BARRIER COATING SYSTEM Patent Application
Stephan Stecura and Curt H. Liebert, inventors (to NASA) Filed 14 May 1976 10 p
(NASA-Case-LEW-12554-1; US-Patent-Appl-SN-686449) Avail: NTIS HC $3.50 CSCL 11C

A coating system is described which contains a bond coating and a thermal barrier coating. It is applied to metal surfaces such as turbine blades and provides both low thermal conductivity and improved adherence when exposed to high temperature gases or liquids. The bond coating contains NiCrAlY and the thermal barrier coating contains a reflective oxide. The reflective oxides ZrO2-Y2O3 and ZrO2-MgO have demonstrated significant utility in high temperature turbine applications. NASA

N76-23360*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
ADVANCED COMPOSITES: FABRICATION PROCESSES FOR SELECTED RESIN MATRIX MATERIALS Space Shuttle Engineering and Operations Support
Erwin K. Welhart 31 Mar. 1976 49 p refs
(Contract NAS9-13970)
(NASA-CR-147704; Rept-1.2-DN-B0104-03) Avail: NTIS HC $4.00 CSCL 11D

This design note is based on present state of the art for epoxy and polyimide matrix composite fabrication technology. Boron/epoxy and polyimide and graphite/epoxy and polyimide structural parts can be successfully fabricated. Fabrication cycles for polyimide matrix composites have been shortened to near epoxy cycle times. Nondestructive testing has proven useful in detecting defects and anomalies in composite structure elements. Fabrication methods and tooling materials are discussed along with the advantages and disadvantages of different tooling materials. Types of honeycomb core, material costs and fabrication methods are shown in table form for comparison. Fabrication limits based on tooling size, pressure capabilities and various machining operations are also discussed. Author

N76-23361# Argonne National Lab., Ill.
FABRICATION AND SUPERCONDUCTING PROPERTIES OF Nb3Al MULTIFILAMENTARY COMPOSITES
J. W. Hafstrom and H. R. Thresh Aug. 1975 18 p refs Presented at the Am. Chem. Soc., Chicago, 24 Aug. 1975
(Contract W-31-109-eng-38)
(CONF-750859-1) Avail: NTIS HC $4.00

The metallurgy, fabrication techniques, and superconducting properties of mono- and multifilamentary alumimum stabilized Nb3Al wire fabricated by bulk diffusion processes are presented in detail. Emphasis is placed on the relationship of the superconducting properties to the process parameters. High superconducting critical current densities are possible in Nb3Al, fabricated by diffusion, only by increasing flux pinning through reduction of the grain size to below 1 mu m. Results of experiments on the control of grain size through the use of nonoxide dispersions and short diffusion times are reported. It was found that the Nb3Al layer thickness is the most significant influencing J/sub c/(H). Zirconium additions were found to accelerate layer growth thus enabling quite short reaction times. Author (NSA)

N76-23362# California Univ., Livermore. Lawrence Livermore Lab.
METHODS FOR NONDESTRUCTIVE TESTING OF COMPOSITE MATERIALS
K. P. Buhmann, H. A. Stelling, and T. Winkler 1974 50 p refs Transl. into ENGLISH from Kunststoffe (West Germany), v. 64, no. 12, 1974 p 750-762 Presented at the 12th Ann.

Public Conv. of the German Reinforced-Plastics Assoc., Freudenstadt, West Germany, 1-4 Oct. 1974 Sponsored by ERDA
(UCRL-Trans-10938-Pt-1; UCRL-Trans-10938-Pt-2) Avail: NTIS HC $5.00

Nondestructive testing has become increasingly important recently for quality assurance and quality control in regard to the proof of required material properties and irregularities which occur in plastics also, especially composite materials. Nondestructive techniques are discussed which have given satisfactory results for a long time in metal testing, and also newer techniques often used for composite materials. The further development of these methods and their value are illustrated by examples.
Author (ERA)

N76-23363# Illinois Inst. of Tech., Chicago.
STRENGTH AND FRACTURE PROPERTIES OF RANDOM FIBER POLYESTER COMPOSITES
S. K. Gaggar and L. J. Broutman Feb. 1975 36 p refs Presented at 30th Anniv. Reinforced Plastics Tech. Management Conf., Washington, D. C., 5 Feb. 1975 Sponsored by ERDA
(COO-1794-25; Conf-750201-2) Avail: NTIS HC $5.00

Random glass fiber reinforced polyester composites are characterized. The concepts of Linear Elastic Fracture Mechanics (LEFM) were applied to obtain meaningful toughness parameters. It is shown that a substantial amount of slow crack growth occurs prior to unstable fracture and thus the total fracture behavior of the material should be studied by applying the concepts of crack growth resistance curves (R-Curves). These curves can then be used to determine the value of candidate stress intensity factor, K/sub Q/, and the point of crack instability. Notch bend fracture tests were performed to estimate the total fracture energy for the material. It is shown that the debonding energy mechanism is dominant in these materials and the total fracture energy can be predicted by considering the energy absorbed in the debonding and the pull out process. ERA

N76-23364# Sandia Labs., Albuquerque, N.Mex.
ROOM TEMPERATURE CREEP OF KEVLAR 49-EPOXY COMPOSITES
R. H. Ericksen Sep. 1975 26 p refs
(Contract AT(29-1)-789)
(SAND-75-0473) Avail: NTIS HC $4.00

The results were compared with creep behavior of individual fibers and unreinforced epoxy. Composites exhibited transient creep throughout the 1000-hour tests; no steady state creep was observed. The shape of the composite creep curves varied with stress. The changes were related to the creep behavior of fibers and matrix tested individually under conditions of strain comparable to those in the composite. At low stresses the matrix initially creeps at a slower rate than the fibers, whereas at higher stresses the reverse situation exists. The time-dependent redistribution of stress between constituents is compared with theoretical treatments for composite creep. Author (ERA)

N76-23365# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
GENERALIZED CONTINUUM THEORIES FOR DIRECTIONALLY REINFORCED SOLIDS Interim Report
J. D. Achenbach Oct. 1975 38 p refs Presented at the Symp. on Continuum Models of Discrete Systems, Jodlowy Dwor, Poland, 23-28 Jul. 1975
(Contract N00014-76-C-0063; NR Proj. 064-483)
(AD-A018235; NU-SML-TR-75-3) CSCL 11/4

A number of specific examples involving the dispersive behavior of fiber-reinforced composites for time-harmonic waves propagating in directions parallel and normal to the fibers are discussed. These cases are relevant to available data of ultrasonic tests. Analytical results are compared with test data, and with some results obtained by the finite element technique. In addition a theory of elasticity with microstructure for fiber-reinforced composites with a rectangular array of the fibers is outlined.
Author (GRA)

N76-23366# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
BALLISTIC TESTING OF PERSONNEL ARMOR MATERIALS Final Report
6 Jan. 1975 20 p Supersedes, MTP-10-2-506
(AD-A018236; TOP-10-2-506; MTP-10-2-506) Avail: NTIS CSCL 19/4

This report describes methods for evaluating the resistance of personnel armor material to perforation by attacking projectile fragments, simulated fragments, and small arms ammunition. It covers physical characteristics of materials, firing tests for ballistic limits of materials, determination of residual velocities, and environmental conditioning. It is not applicable to material actual armor configuration. GRA

N76-23367# Advisory Group for Aerospace Research and Development, Paris (France).
FATIGUE IN COMPOSITE MATERIALS
K. L. Reifsnider (Vir. Polytechnic Inst. and State Univ.) Feb. 1976 28 p refs
(AGARD-R-638) Avail: NTIS HC $4.00

A general overview of fatigue of composite materials is presented from the standpoint of basic characteristics and concepts, especially in the context of fatigue behavior of more familiar materials. Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-23368 British Library Lending Div., Boston Spa (England).
DETERMINATION BY ATOMIC ABSORPTION SPECTROPHOTOMETRY OF ZINC, CALCIUM, BARIUM AND MAGNESIUM IN MINERAL OIL PRODUCTS. EMULSION METHOD
U. Ulricht-Hopp Sep. 1975 8 p Transl. into ENGLISH from Eroel Kohle (Hamburg), vol. 27, no. 8, Aug. 1974 p 435-436
(BLL-DRIC-Trans-4066-(3623.66); BR45161) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A method is described for the atomic absorption spectrophotometric determination of Zn, Ca, Ba and Mg in mineral oils and their products, in which the sample is not dissolved in organic solvents, in contrast to the procedures known so far, but is emulsified in water. The method is economical and improves the safety of operation by avoiding flammable solvents. Author

N76-23369 British Library Lending Div., Boston Spa (England).
RIG FOR TESTING HIGH TEMPERATURE CORROSION OF HEAT RESISTING STEELS IN CONTACT WITH COMBUSTION PRODUCTS
P. I. Anson and Ya. P. Laid Jan. 1976 7 p Transl. into ENGLISH from Tr. Tallinsk. Politekh. Inst. Ser. A (USSR), no. 277, 1969 p 51-57
(BLL-RTS-9556) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

A description of the test apparatus (a modified oil fired boiler) used in the study of fuel oil combustion product effects on a KH25T steel is given. A comparison of corrosion tested KH25T steel specimens in contact with air and shale oil ash as a function of temperature is given. Temperatures ranged from 900 C to 1200 C. Results are presented and discussed. J.R.T.

N76-23370 British Library Lending Div., Boston Spa (England).
MEASUREMENT OF THE CONCENTRATION OF GAS IN A GAS-LIQUID EMULSION BY ABSORPTION OF GAMMA RAYS
R. Hours [1975] 12 p ref Transl. into ENGLISH from Comm. Energie At. (France), Rappt. 521, 1955
(BLL-M-23988-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A method is described of measuring the concentration of gas in a two-phase heterogeneous gas-liquid flow system, where the gaseous phase is broken up into a large number of bubbles,

distributed throughout the liquid. It is assumed, that the average velocity of the system is constant, and that the fluid is homogeneous in the sense that the gas bubbles are small and distributed throughout the liquid in a uniform manner. Author

N76-23371 British Library Lending Div., Boston Spa (England).
A METHOD OF SEPARATING AND RECOVERING CARBON DIOXIDE FROM GASEOUS ADMIXTURE
Giuseppe Giammarco [1975] 14 p Transl. into ENGLISH from Italian Patent no. 518145 In ENGLISH and ITALIAN
(BLL-M-23955-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The patent of an invention that may be used to separate and recover carbon dioxide from a gaseous admixture was presented. The proposed technique utilizes the action of organic nitrogenous substances which occur in living organisms or take part in the physiological process whereby carbon dioxide is expelled from living cells via the respiratory tract as well as certain non-physiological substances. The addition of these substances produces an increase in the absorptive carbon dioxide, and equilibrium is maintained while the velocity of the reaction is notably increased. The corrosion of ferrous metals, induced by amino acids, may be inhibited by the use of an excess of alkali equivalent to at least 1.5 times the quantity stoichiometrically required for complete neutralization of the amino acids. Y.J.A.

N76-23372 British Library Lending Div., Boston Spa (England).
SPEED OF SMOKE MOVEMENT ALONG A PASSAGE. A REPORT ON FIRE EXPERIMENTS IN THE TOKYO MARINE AND FIRE INSURANCE COMPANY LIMITED BUILDING
K. Kawagoe and F. Saito Dec. 1975 23 p Transl. into ENGLISH from Kasai (Japan), v. 17, no. 3, 1967 p 8-14
(BLL-RTS-7302) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 40 BLL photocopy coupons

The speed of smoke movement along a passage and its density in a full scale fire was analyzed to explain the relationship between a full scale fire experiment and a smoke candle experiment using alcohol as a heat reservoir. At the same time the smoke proofing of a shutter was also studied. Author

N76-23373 British Library Lending Div., Boston Spa (England).
SMOKE CLEARANCE BY PRESSURIZATION OF CORRIDOR: A REPORT ON FIRE EXPERIMENTS IN THE TOKYO MARINE AND FIRE INSURANCE COMPANY LIMITED BUILDING
S. Fujii Dec. 1975 19 p Transl. into ENGLISH from Kasai (Japan), v. 17, no. 3, 1967 p 15-18
(BLL-RTS-7303) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

When a corridor is pressurized in the case of fire, the amount of smoke flowing out into the corridor will decrease, which serves favorably, not only for the escape of the victims, but also for the fire fighting operation. In the present experiment, the amount of air pumped into the corridor to pressurize the corridor was about 230 cu m/minute. Calculating from the volume of the rooms facing this corridor, this amount is equivalent to about 5-fold air replenishment. This extent of air replacement is very common for ordinary air conditioning systems, and therefore if some sorts of measure are taken to release the air from the air conditioning system into the corridor completely at the time of fire, it may be very effective. Author

N76-23374 British Library Lending Div., Boston Spa (England).
PROCESS FOR MONITORING THE OXYGEN CONTENT IN LIQUIDS
H. Sundermann [1975] 14 p Transl. into ENGLISH of West German Patent P 2357 037.8-52; Intern. Classification G 01 N 27-56 and G 01 N 33-20
(BLL-Risley-Tr-2917-(9091-9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

An electro-chemical measuring cell which contains an oxygen ion-conducting solid electrolyte measures the electro-motive force of the drop in oxygen partial pressure between the liquid and the solid electrolyte in relation to the temperature and with reference to a reference electrode which has a constant oxygen partial pressure in the measured range. The measured value and the temperature are recorded and the oxygen content of the liquid is calculated from the measured value with the inclusion of at least one comparison value. The invention further concerns a process for using a predetermined content of oxygen in a liquid to monitor the transport of oxygen from a liquid which contains it in small quantities, the electro-motive force which corresponds to the initial oxygen content of the liquid being first determined. Author

N76-23375 British Library Lending Div., Boston Spa (England).
CALCULATING THE COMBUSTION OF FUEL OIL IN A LINED CHAMBER OF LIMITED EXTENT
V. M. Baboshin [1975] 10 p refs Transl. into ENGLISH from Izv. Vysshika Vchebn., Chernaya Met. (Moscow), no. 5, 1975 p 146-149
(BLL-M-25201-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A basis is given for the correction for longitudinal radiation by a flame. Four boundary conditions are formulated for heat transfer between the flame and the refractory lining walls, and energy equations are written for these conditions; new equations for temperature distribution are obtained by solving these for different omega = f(x); the new equations more fully represent the physical essentials of the processes of combustion of fuel oil. New relationships are given for determining the maximum flame temperature taking into account the longitudinal transfer of heat by radiation. The maximum temperature and their locations relative to the nozzle mouth are determined by successive approximations. The theoretical calculations are compared with experimental data. Author

N76-23376 British Library Lending Div., Boston Spa (England).
ACCUMULATION AND FLOW OF SMOKE TO UPPER FLOORS: A REPORT ON FIRE EXPERIMENTS IN THE TOKYO MARINE AND FIRE INSURANCE COMPANY LIMITED BUILDING
T. Moriya and A. Watanabe Dec. 1975 20 p Transl. into ENGLISH from Kasai (Japan), v. 17, no. 3, 1967 p 19-23
(BLL-RTS-7304) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; BLL photocopy coupons

If fire breaks out in a building, in which upper and lower floors are linked by only one ordinary stairway which is not protected against smoke by 'smoke tower' + 'front room' facility or by pressurization, how will the smoke flow from stairway to the upper floors, how will it accumulate, how will it move from the corridor into rooms by seeping through the door, what will be the time factor, and what will be the degree of danger? An experiment to study these problems is presented. Author

N76-23377 West Virginia Univ., Morgantown.
SEMIINTEGRAL ELECTROANALYSIS Ph.D. Thesis
Steven Charles Lamey 1975 159 p
Avail: Univ. Microfilms Order No. 76-11771

A method has been developed for the qualitative and quantitative analysis of electroactive species at a stationary electrode in flowing streams employing semiintegral analysis. Studies have been undertaken at a hanging mercury drop electrode immersed in a flowing stream of para-nitrobenzoic acid in a DMF-phosphate buffer mixture to determine the effect of convection on the current semiintegral. The results of these studies indicate that the current semiintegral is unaffected by convection at flow rates up to .023 cm/sec. One application for this type of analysis would be as a detector in a liquid chromatograph. Dissert. Abstr.

N76-23378 Houston Univ., Tex.
APPLICATION OF THE GAS CHROMATOGRAPH--MASS SPECTROMETER IN THE ANALYSIS OF: 1. THE APOLLO 16 AND 17 LUNAR SAMPLES. 2: VOLATILE COMPOUNDS IN URINE AND OTHER BODY FLUIDS OF TUMOR-BEARING MICE Ph.D. Thesis
Annette Mary Lovett 1975 155 p
Avail: Univ. Microfilms Order No. 76-9916

The Apollo 16 lunar samples were subjected to stepped pyrolyses up to 1000 C and the organogenic compounds N2, CO, CO2, CH4, H2O and C1 - C3 hydrocarbons released were analyzed by gas chromatography-mass spectrometery. The acid treatment of the Apollo 17 samples resulted in the decrease of deuterated to nondeuterated ratios progressing from C1 to C3 indicating that hydrolysis of reactive carbon species produces

primarily methane. The hydrocarbons released by acid treatment of rocks were considerably less than by volatilization possibly due to the trapping of hydrocarbons in the crystalline matrix or microvesicles and only released by pyrolysis. A preliminary study in the endeavor to, eventually, detect cancer at a reasonably early stage has been attempted. The volatile metabolites in urine, blood plasma and abdominal fluid of normal mice and mice bearing the Ehrlich Ascites tumor were collected using the headspace sampling technique and analysed using both the GLC-FIC (Varian 1400) and GLC-MS (LKB 9000) systems. The differences upon comparison between normal urine were examined with caution, eliminating any inconsistent changes. A terpene, piperitenone, has been identified in the urine of abnormal mice only, and has served as an index for the presence of Ehrlich Ascites tumor cells in mice. Dissert. Abstr.

N76-23379 Wayne State Univ., Detroit, Mich.
THEORY OF COMBUSTION OF A TURBULENT SPRAY INCLUDING THE EFFECTS OF DROP-SIZE AND FLAME GENERATED TURBULENCE Ph.D. Thesis
Kwan Ho Im 1975 179 p
Avail: Univ. Microfilms Order No. 76-10962

A theoretical description of the heterogeneous combustion of a turbulent spray of liquid drops (kerosene) is developed. It is a differential description of the two phases which includes both the single-drop processes and the effect of turbulence on the single-drop burning as well as on the transport process. A key feature is a model for the amplification of the turbulence due to the flame. The flame speed is calculated as a function of the flame parameters and the results are found to compare very favorably with the data of Mizutani and Nishimoto. The flame thickness, overall reaction rate, heat release rate and temperature profile are also calculated for various values of the flame parameters. As an application of this model, the corresponding reactor models are derived. The resulting models are expected to be improvements of the existing ones which take into account both turbulence and the existence of drops.
Dissert. Abstr.

N76-23380 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE CHARACTERISTICS OF SELF-SUSTAINED PARTICULATED BORON COMBUSTION IN AIR AT AMBIENT PRESSURE Ph.D. Thesis
Lowell Wesner Ormand 1974 163 p
Avail: Univ. Microfilms Order No. 76-6501

A steady state, self-sustained flame of elemental boron in air at atmospheric pressure was investigated to evaluate the theoretical analysis. A particulate cloud of boron was ignited using a hydrogen flame; once the flame was established, the hydrogen supply was removed. The flame was then allowed to stabilize as a self-sustained, steady state flame. Combustion gas sampling and absorption-emission measurements were taken to evaluate the combustion efficiency and temperature. These data were taken at the combustor exist plane for combustors 1.9 to 7.62 centimeters in diameter and up to 76 centimeters in length. Particulate concentrations providing fuel-to-air equivalence ratios ranging from one to two at air mass fluxes up to 6.35 gm/sq cm were investigated. Dissert. Abstr.

N76-23381 Pennsylvania State Univ., University Park.
A SEMI-EMPHIRICAL STUDY OF THE TRUE CRITICAL PROPERTIES OF DEFINED MIXTURES Ph.D. Thesis
Calvin Frank Spencer 1975 341 p
Avail: Univ. Microfilms Order No. 76-10795

A knowledge of the true critical properties of defined mixtures is useful in high presure process design, a valuable aid in flash calculations, helpful in interpreting vapor-liquid equilibrium data, and a key point in the construction of K-charts and phase diagrams. A sequence of generalized equations for predicting the true critical temperature, pressure, and volume of defined mixtures which eliminates deficiencies in the existing methods is presented. Two correlational approaches, empirical and statistical thermodynamic, have been considered in detail. A modified statistical approach was more successful for correlating critical temperature but failed for the other two critical properties. Critical pressure has been correlated indirectly via an equation of state, and critical volume was best represented by excess volume theory. Dissert. Abstr.

N76-23382 Saskatchewan Univ., Saskatoon.
EFFECTS OF MASS TRANSPORT ON THE ANODIC DISSOLUTION OF IRON AND COPPER IN AQUEOUS SOLUTIONS Ph.D. Thesis
Edward Fiadzigbe 1975 165 p
Avail: Univ. Microfilms Order No. 76-10533

The anodic dissolution of iron and copper was studied in deaerated, flowing sulphuric acid solutions at a bulk pH of 1:3. These metals were selected to cover the 'abnormal' (transition) and 'normal' metals, respectively. Steady-state polarization results were obtained from galvanostatic tests, and a transient electrochemical technique was applied to determine the ohmic overpotentials. An experimental model comprised flat-plate electrodes mounted in a flow cell of rectangular geometry. The duct was designed to behave hydrodynamically as a 'slit' and to allow the development of the hydrodynamic boundary-layer. Results show that for both metals the steady-state polarization uncorrected for IR drops, departs from Tafel behavior and shifts towards more positive potentials with decreasing flow. In turbulent flow the IR drops increase linearly with current density, but in laminar flow the relationships are characterized by nonlinearities that are sensitive to diminishing flow. Dissert. Abstr.

N76-23383 Colorado Univ., Boulder.
MAGNETOSEDIMENTATION Ph.D. Thesis
Walter John Simonsen, Jr. 1975 99 p
Avail: Univ. Microfilms Order No. 76-11607

An inhomogeneous magnetic field causes translational motion of dissolved molecules. This phenomenon is termed magnetosedimentation. Equations are derived which describe the effect of a magnetic field gradient upon the chemical potentials of the components of a solution at equilibrium. The effect depends principally upon the magnetic field strength and the magnetic susceptibilities of solute and solvent. This general theory is applied to several physically realizable situations. Measurable magnetosedimentation effects were observed using a special apparatus. The design and construction of this apparatus is described, as are then experimental technique and data reduction methods. Various experiments demonstrating the magnetosedimentation effect are presented. In its application to measuring the molecular weights of macromolecules, data are obtained which agree quantitatively with the predictions of the theory.
Dissert. Abstr.

N76-23384 Boston Coll., Chestnut Hill, Mass.
A SPECTROSCOPIC STUDY OF LOW-PRESSURE BENZENE-OXYGEN FLAMES Ph.D. Thesis
Maxyne Dorothy Schneider 1976 183 p
Avail: Univ. Microfilms Order No. 76-10392

Measurements of absorbance are made in low pressure flat flames of benzene--oxygen--nitrogen with C:O ratios that range from 0.297 to 0.507. Absorption occurs at the same wavelengths as in shock tube study, but now under soot free conditions, indicating that sooting may not have been a great problem. There is evidence to indicate that the absorptions are due, in large part, to aromatic species. The trend in the ratio of the absorbances at 6500 A and 3000 A as oxygen concentration is increased is in accord with what is expected on the basis of the assignment of the absorptions to biphenyl radical and biphenyl molecule, respectively. Dissert. Abstr.

N76-23385 Arizona Univ., Tucson.
ANALYSIS OF INSOLUBLE ORGANIC MATERIAL IN CARBONACEOUS METEORITES BY COMBINED VACUUM PYROLYSIS-GAS CHROMATOGRAPHY-MASS SPECTROMETRY Ph.D. Thesis
Eric Lord Bandurski 1975 91 p
Avail: Univ. Microfilms Order No. 76-11325

The polymer like organic material in the Orgueil (CI) chondrite was analyzed by high vacuum pyrolysis/gas chromatography/mass spectrometry. Orgueil powder, previously solvent extracted to remove all soluble organic compounds, was pyrolyzed in temperature steps at 150, 300, 450, and 600 C. Gas chromatographic/mass spectrometric analysis of the vacuum pyrolyzates revealed a series of alkenes to C8, an extensive series of alkylbenzene isomers, thiophene, alkylthiophenes, and benzothiophene, and the nitrogen compounds acetonitrile, acrylonitrile, and benzonitrile. Comparison of the Orgueil polymer fragments

with those reported in polymer analyses of the Murchison and Allende meteorites suggests that qualitatively and quantitatively the Orgueil and Allende polymeric materials are very similar. Dissert. Abstr.

N76-23386 British Library Lending Div., Boston Spa (England).
CHEMICAL ANALYSIS AS A PRODUCTION GUIDE
H. Bouzigues, A. Fontaine, and P. Pabigny 1975 16 p Transl. into ENGLISH from Bull. Inf. Sci. Tech. (Paris), v. 200, Feb. 1975 p 9-22
(BLL-Dounreay-Tran-696(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Chemical analysis is seen as one of the essential tools for directing an industrial enterprise because the quantities it provides can have serious economic consequences through providing a balance-sheet for a process or giving diagnostic information on a production unit. Finally, it is sometimes a powerful agent in deciding, in the realms of future prospects, in indicating improvements to procedures which would justify expansion. The place analysis holds in large industrial undertakings in different aspects of nuclear fuel production is discussed. Author

N76-23387*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A PROCESS OF FORMING CATALYTIC SURFACES FOR OXIDATION REACTIONS Patent Application
Robert Bruce Jagow, inventor (to NASA) (LMSC Sunnyvale, Calif.) Filed 10 May 1976 14 p Sponsored by NASA
(NASA-Case-MSC-14831-1; US-Patent-Appl-SN-685027) Avail: NTIS HC $3.50 CSCL 07D

A wet oxidation process for oxidizing waste materials comprising dissolving a ruthenium salt in a reactant feed stream containing the waste materials is described. The feed stream is introduced into a reactor, and the reactor contents heated to an elevated temperature to effect deposition of a catalytic surface of ruthenium black on the interior walls of the reactor. The stream is maintained, feeding into the reactor for a period of time sufficient to effect at least partial oxidation of the waste materials. NASA

N76-23388# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
MEASUREMENT OF THE GAS DENSITY OF URANIUM HEXAFLUORIDE BY LASER RAMAN SCATTERING
W. F. Adolfson, R. G. Schlecht, and J. B. Morton Jul. 1975 64 p refs
(Contract E(40-1)-1779)
(UVA-ER-001-75U) Avail: NTIS HC $6.25

This investigation demonstrates the feasibility of using laser Raman scattered light to measure the gas density of uranium hexafluoride over the pressure range 1-72 Torr. Light scattered at right angles from the laser beam is collected by a lens arrangement, analyzed with a monochromator, and recorded with a dc amplifier and photomultiplier system. A review of the pertinent concepts describing the Raman effect is presented, and the sources of background, of which dark current was the most significant, are discussed. The first fundamental vibrational frequency of UF6 is located at 665/cm, and had a 2.5/cm linewidth and 0.024 depolarization ratio. The peak differential cross section of this line measured relative to the 992/cm line of benzene, is 1.2 x 10 to the 29th power + or - 9 percent sqcm/mol. sr./cm. The intensity of the scattered light remains linear over one and one-half orders of magnitude. Author (ERA)

N76-23389# Mellon Inst., Pittsburgh, Pa. Radiation Research Labs.
[RADIATION RESEARCH, INCLUDING STUDIES ON ELECTRON SPIN RESONANCE AND RADIOLYSIS] Annual Report
10 Oct. 1975 31 p Sponsored by ERDA
(RRL-3238-542) Avail: NTIS HC $5.00

The status of the following research studies is reported: steadystate radiolysis-ESR studies; ESR studies of photolytically produced radicals; time resolved ESR spectroscopy; optical pulse radiolysis studies; studies on alkoxy radicals; mechanism of reaction of oxidizing radicals; pulse radiolysis studies of chloride solutions; one-electron redox potentials of radicals; liquid chromatographic examination of radiation produced products; and numerical methods for the treatment of complex reaction kinetics. ERA

N76-23390# California Inst. of Tech., Pasadena. Arthur Amos Noyes Lab. of Chemical Physics.
AN APPROACH TO THE UNDERSTANDING OF RADIATION CHEMISTRY IN THE CONDENSED PHASE
Jacqueline O. Berg and G. Wilse Robinson 27 Feb. 1975 7 p refs Repr. from Chem. Phys. Lett. (Amsterdam), v. 34, no. 2, 15 Jul. 1975 p 211-215
(Contract DAHC04-74-C-0010)
(AD-A018510; ARO-11783.6-C) Avail: NTIS CSCL 07/5

This paper describes a purely electronic mechanism by which approx. 20 eV excitations in condensed phases relax to lower energy states. The mechanism utilizes an energy fission process whereby an ionic or excitonic state splits into two lower energy states, at least one being localized. The mechanism explains not only the known rapidity of such process but also suggests an explanation for the proportionation of the chemistry between ionic and electronically excited states. Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-23391 British Library Lending Div., Boston Spa (England).
EFFECT OF SLIP GEOMETRY ON THE as-ROLLED TEXTURE OF BODY-CENTERED CRYSTALLINE MATERIALS
V. N. Barsukov, Ya. D. Vishnyakov, and Ya. S. Umanskii 1975 12 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (Moscow), no. 5, 1975 p 89-94
(BLL-M-25221-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The effects of normal octahedral slip (primary, conjugate and transverse slips), non-octahedral slip, partial dislocations and the most probable combinations of these types of slip on the texture formed in metals and alloys with a body-centered lattice structure and various packing defect energies after rolling with significant reductions are dealt with theoretically. Author

N76-23392 Denver Univ., Colo.
TENSILE FRACTURE IN DUCTILE METALS Ph.D. Thesis
Glen Allan Rowell 1975 93 p
Avail: Univ. Microfilms Order No. 76-10295

The role of continuum stresses and strains in tensile fracture initiation is investigated in a series of tests on flat plates and rods made from aluminum alloys. A method of measuring the permanent plastic surface strains at the root of a rounded notch is developed. Using the work hardening properties of the material, equations are derived which relate the stresses to the surface strains. In a variety of biaxial and triaxial stress states, tensile fracture is found to initiate at a given value of maximum tensile stress. The effect of section size is investigated in a series of tensile tests on smooth and notched rods. Although definite size effects are seen in the notched rods, no contradiction to the continuum approach to fracture prediction is found. Finally, the results of a torsion test, in which fracture initiates in tension, confirm the validity of the continuum approach. Dissert. Abstr.

N76-23393 British Library Lending Div., Boston Spa (England).
THE VALUE OF SURFACE-PROTECTIVE MEDIA AGAINST FRETTING CORROSION ON THE BASIS OF FATIGUE STRENGTH TESTS
E. Gassner Oct. 1975 10 p refs Transl. into ENGLISH from Lab. Betriebsfestigkeit (West Germany), 1967 Rept. TM-19/67 (BLL-RAE-Lib-Trans-1868-(5207); TM-19/67) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A fatigue test specimen is described which has been designed specifically for evaluating the effect of anti-fretting media on fatigue life. By varying the method of assembly the specimen can be made to fail at areas of fretting accompanied by high or low stress concentration, or at a stress concentration without fretting. The use of this specimen in assessing anti-fretting media is discussed. Author

N76-23394 British Library Lending Div., Boston Spa (England).
STRUCTURE AND PROPERTIES OF ALLOYED CAST IRON WITH SPHEROIDAL GRAPHITE AFTER ISOTHERMAL HARDENING
A. A. Pavlyuchenko and L. A. Solntsey [1975] 9 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 4, 1975 p 141-143 In ENGLISH and RUSSIAN
(BLL-M-25199-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The results are presented of investigations of the influence of alloying with copper and nickel on the structure and properties of castings of spheroidal-graphite cast iron after isothermal treatment. Nickel and copper increase the stability of supercooled austenite and the cast-iron hardenability. The optimum combination of strength and ductility is obtained by isothermal treatment at 350-400 and 550-600 C. Author

N76-23395 British Library Lending Div., Boston Spa (England).
EXPERIMENT DESIGNING FOR INVESTIGATION OF THE PLASTICITY OF METALS
B. A. Migachev, E. L. Vorobeva, A. I. Potapov, A. A. Bogatov, and V. L. Kolmogorov [1975] 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 4, 1975 p 93-97
(BLL-M-25198-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The advisability of applying multidimensional statistical methods (orthogonal experiment designing) to investigation of the plasticity of metals at high temperatures is examined. The approach adopted provides a means of accurately determining and analytically describing the metallic property in question as a function of the deformation temperature and speed conditions, the stressed state, the chemical composition, and other processing factors. Author

N76-23396 British Library Lending Div., Boston Spa (England).
INFLUENCE OF STRESS, HEAT TREATMENT AND JOINING ON INTERGRANULAR CRACKING OF INCONEL ALLOYS 600 AND 750
J. Blanchet, H. Coriou, L. Grall, C. Mahieu, C. Otter, and G. Turluer 1 Sep. 1975 29 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 55, 1975 p 187-206 Presented at the 5th European Corrosion Congr., Paris, 24-28 Sep. 1973
(BLL-Risley-Tr-2898-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The stress-corrosion cracking of alloys of the Inconel 600 type in high-temperature water is examined. The influence of the following variables was studied: stress, heat-treatment, joining, grain-size, structure. A hypothesis based on the presence of sulphur compounds in the alloy, is advanced to account for the mechanism of cracking. Author

N76-23397 British Library Lending Div., Boston Spa (England).
MECHANISM OF REACTION DIFFUSION BETWEEN IRON AND ALUMINIUM IN THE SOLID STATE
D. I. Lainer and A. K. Kurakin Jan. 1976 15 p refs Transl. into ENGLISH from Tekhnol. Legkikh Splavov (USSR), no. 6, 1967 p 72-82
(BLL-RTS-9947) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

Modern methods have been used for structural research into the interlayer developing during diffusion processes between iron and aluminum in the solid state. It has been shown that there are thin layers (about 0.01 thick) at the dividing surface between iron and aluminum; the structure and composition of these layers have been determined. The mechanism of reaction diffusion between iron and aluminum in the solid state has been established. The process of reaction diffusion is of a mutual nature, mostly comprising the movement of atoms of iron into the aluminum. It has been confirmed by experiments that the development of chemical compounds during reaction diffusion, at the dividing surface between iron and aluminium, is related directly to the heat of their formation. Laws have been found for the diffusion process between iron and aluminum; on the basis of these it is possible to plan methods of providing iron-aluminum clad metals with particular properties, also by analogy to provide other pairs of metals with particular properties. Author

N76-23398 British Library Lending Div., Boston Spa (England).
CONTACTLESS DEFORMATION WHEN DRAWING BIMETAL WIRE WITH SOFT CLADDING, COMMUNICATION 1
Yu. I. Kokovikhin, M. G. Polyakov, I. Sh. Tuktamyshev, and A. A. Kalchenko [1975] 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (USSR), v. 10, 1975 p 80-83
(BLL-M-25321-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Theoretical aspects of the generation of contactless deformation in drawing bimetal wire with soft cladding are considered. Expressions are obtained, describing contactless deformation in the entering plane of the draw plate, and enabling drawing conditions to be selected in which it is completely absent. The theoretical solutions are tested in practice in mastering the industrial production of steel-aluminum wire. Author

N76-23399 National Lending Library for Science and Technology, Boston Spa (England).
UPPER ASSESSMENT OF THE SPECIFIC FORCES DURING THE UPSETTING OF A PARALLELEPIPED THREE-DIMENSIONAL DEFORMATION
Yu. A. Alyushin, A. S. Seregin, and V. V. Erasmov [1975] 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 10, 1975 p 96-99 In ENGLISH and RUSSIAN
(NLL-M-25322-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The use of accurate methods for analyzing three-dimensional deformation results in cumbersome and difficult to analyze relationships. At the expense of a slight reduction in accuracy the specific deformation forces can be calculated more simply from the kinematically possible speed fields of rigid blocks. Such speed fields are plotted for the upsetting of a parallelepiped between two parallel plates. The analysis, and a function for calculating the specific forces are presented. The relative simplicity of the calculation makes the proposed solution convenient for practical problems. Author

N76-23400 Cincinnati Univ., Ohio.
HEAVY ION INDUCED RADIATION DAMAGE AND VOID FORMATION IN MOLYBDENUM AND ITS ALLOYS Ph.D. Thesis
James Frederick Stubbins 1975 292 p
Avail: Univ. Microfilms Order No. 76-1914

The development of defect microstructure with irradiation dose and irradiation temperature was studied for doses up to 60 displacements per atom (dpa) and at temperatures ranging from 750 C (35 Tm) to 1500 C (.61 Tm). Specifically, quantitative and qualitative data were obtained for the void, dislocation loop and line, and precipitate populations; and the void volume fractions (swelling) were calculated. The dose dependence of swelling was studied for Mo, TZM and Mo-.5Ti SG (Mo-.5Ti with 1 micron grain diameter) between 850 C (.39 Tm) and 1120 C (.48 Tm), and at 905 C for Mo-.5Ti LG (Mo-.5TI with 23 micron grain diameter). The void volume fraction was found to be a linear function of dose for Mo over the entire temperature range. At 900 C, Mo developed a void volume fraction of 2.7% by 50 dpa. At higher temperatures the swelling increased more rapidly with dose. Dissert. Abstr.

N76-23401 Ohio State Univ., Columbus.
CORROSION FATIGUE, TYPE 304 STAINLESS STEEL IN ACID-CHLORIDE AND IMPLANT METALS IN BIOLOGICAL FLUID Ph.D. Thesis
David Francis Bowers 1975 418 p
Avail: Univ. Microfilms Order No. 76-9939

Fatigue crack growth data were obtained for type 304 stainless steel in air and a 5N H2SO4-1N NaCl solution. The crack propagation data were attained at a cyclic frequency of 3Hz and a stress ratio of 0.05. The corrosion fatigue behavior of five biomedical alloys was studied as a function of applied stress, pH, and applied potential. These alloys which are predominatly used in orthopedic surgery were as follows: type 316 LVM stainless steel, wrought Vitallium, commercially pure titanium, Ti-6 Al-4V, and multiplhase alloy MP-35N. The tests were conducted in reversed cantilever bending at zero mean stress. In addition, the open circuit potential was continuously

monitored throughout the fatigue test. These measurements were also used in a study of fatigue crack initiation. The results are presented in the form of S-N type plots, potential-time curves, and applied potential-endurance plots. Dissert. Abstr.

N76-23402 Ohio State Univ., Columbus.
SOME ASPECTS OF THE PHYSICAL METALLURGY AND WELDABILITY OF 10 NICKEL MODIFIED STEEL Ph.D. Thesis
James A. Snide 1975 132 p
Avail: Univ. Microfilms Order No. 76-10050

Optical and transmission microscopy and X-ray techniques were used to study the structural changes during various thermal treatments of the steel. Hardness measurements, tensile tests, notch tensile tests, Charpy V-notch impact, and precracked Charpy V-notch slow bend tests were used to evaluate the mechanical behavior. Lath martensite formed upon quenching from the austenitizing temperature with a very fine prior austenitic grain size (GS 16). The alloy exhibited secondary aging behavior.
Dissert Abstr.

N76-23403 Lehigh Univ., Bethlehem, Pa.
NON-ISOTHERMAL DIFFUSION CONTROLLED PHASE GROWTH IN TERNARY SYSTEMS AND ITS APPLICATION TO IRON METEORITES Ph.D. Thesis
Erik Randich 1976 133 p
Avail: Univ. Microfilms Order No. 76-10372

Cooling rates were determined for seven hexahedrites (chemical classification group IIa) by modeling the growth of schreibersite (Fe,Ni)3P) in kamacite. The phase growth model was created for non-isothermal diffusion-controlled phase growth in ternary systems. It incorporates methods for determining phase growth velocity, interface compositions and compositional gradients consistent with the diffusion rates of both solute elements. The model can be applied to any ternary system provided pertinent portions of the phase diagram and ternary diffusion coefficients are known at the temperatures of interest. The ternary phase growth model was applied to the growth of schreibersite in hexahedrites. Several cooling rates were simulated for each meteorite. Actual cooling rates were determined by a cooling rate curve analysis which measured phosphide sizes and phosphide Ni contents were compared with simulated results to uniquely define a hexahedrite's cooling rate. Dissert. Abstr.

N76-23404 Cornell Univ., New York.
A STUDY OF FRACTURE MECHANICS. PART 1: STRESS CHARACTERIZATION IN THE FATIGUE CRACK TIP PLASTIC ZONE. PART 2: AN EXAMINATION OF THE CORROSION FATIGUE CRACK TIP ZONE. PART 3: CYCLIC SOFTENING OF 4340 AND MARAGING HIGH STRENGTH STEELS Ph.D. Thesis
Lawrence Kai Lai Tu 1975 226 p
Avail: Univ. Microfilms Order No. 76-9573

The fatigue crack tip plastic zone in 1100 aluminum in the plane stress regime was characterized by interferometry, microhardness, and transmission electron microscopy (TEM) techniques. The plastic zone size was in rough accord with the prediction of a modified Dugdale model. The corrosion fatigue crack tip zones of 7075-T6 aluminum exposed to air, water and 3.5 wt pct NaCl solution were examined by interferometry and TEM techniques. The fatigue crack growth rates are higher in the water and the NaCl solution than in air. The effect of plastic strain cycling upon 4340 and maraging high strength steels was examined by mechanical property, TEM, and X-ray line broadening measurements. The X-ray studies indicate that a decrease in microstrain accompanies cyclic softening of 4340 and annealed maraging steels, but that the microstrain increases slightly with plastic cycling of aged maraging steel.
Dissert. Abstr.

N76-23405 Connecticut Univ., Storrs.
BEHAVIOR OF SULFIDE INCLUSIONS DURING THERMO-MECHANICAL PROCESSING OF STEEL Ph.D. Thesis
Yellapu V. Murty 1975 134 p
Avail: Univ. Microfilms Order No. 76-10278

Treatment consisted of hot rolling at 950 C followed by homogenization at 1310 C for various lengths of time. Emphasis was placed on the effect of cooling rate during solidification and alloy composition on the response of sulfides to thermomechanical treatment. During hot rolling of directionally solidified AISI 4340 low alloy steel, the sulfide inclusions plastically deformed to different degrees according to their composition. Those which solidified fast under nonequilibrium freezing conditions were richer in iron and deformed more heavily than those which solidified slower and were poorer in iron. During subsequent homogenization, iron was rejected from the iron-rich (Mn,Fe)S inclusions and manganese was accepted from the surrounding steel matrix in an attempt of the sulfides to reach equilbrium composition. Dissert. Abstr.

N76-23406 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELASTIC ANISOTROPY OF TEXTURED IRON POLYCRYSTALS Ph.D. Thesis
Philip Orin Metz 1976 182 p
Avail. Univ. Microfilms Order No. 76-11658

Samples of two heats of interstitial-free low-carbon steel rolled sheet are examined. The texture is characterized by pole figures and by a set of ideal orientations which are consistent with those pole figures. The variation of Young's Modulus in the rolling plane of the sheet materials is determined. The observed elastic behavior is analyzed by two methods. First bounding procedures are used to establish the best description of the texture present in terms of ideal orientations. Then a finite element method model consisting of 48 isostrain elements representing grains is constructed. This model is employed to examine the effects of the arrangement of grains within a representative volume element upon the elastic properties of a material having a given texture in terms of its ideal orientation description.
Dissert. Abstr.

N76-23407 Yale Univ., New Haven, Conn.
KINETICS AND MECHANISM OF DISSOLUTION AND GASIFICATION IN HIGH TEMPERATURE GAS/METAL SYSTEMS. INTERACTION OF TANTALUM, NIOBIUM AND VANADIUM WITH PARTIALLY DISSOCIATED NITROGEN AND/OR OXYGEN Ph.D. Thesis
Heng Henry Feng 1975 311 p
Avail. Univ. Microfilms Order No. 76-11513

A relaxation method, based on the isothermal response of electrical resistance of less than or equal to 0.5 mm. diameter polycrystalline Ta(s), Nb(s), and V(s) filaments to step-changes in imposed atomic and diatomic gases (oxygen and/or nitrogen), is used to study the kinetics and mechanism of engassing and degassing in such gas-metal systems. At sufficiently high temperature (above 1200 K) and low partial pressures of active gases, dissolution processes were found to be within the homogeneous solid solution regions. The mechanism of transient engassing and degassing shifted from one of adsorption-desorption control at low pressures and temperatures to interface crossing or bulk diffusion control at high pressures and temperatures. Dissert. Abstr.

N76-23408 Yeshiva Univ., New York.
ON THE KINETICS OF PHASE TRANSITIONS IN BINARY ALLOYS Ph.D. Thesis
Joaquin Marro 1975 323 p
Avail: Univ. Microfilms Order No. 76-10327

The computer simulation of the time evolution of a model binary alloy following quenching is described. Two different types of interactions are considered: a 'ferromagnetic' interaction which produces, at low temperatures, a segregation into two phases (one A-rich and one B-rich), and an 'antiferromagnetic' interaction which produces, at low temperatures and certain system compositions, some alternate ordering. The model is started with an initial random configuration (T = infinity) and its evolution and equilibrium properties are studied at different temperatures and compositions in the one- and two-phase regions of the corresponding phase diagram. Results are presented for the evolution of the structure function, Fourier transform of the spatial correlation function, and of the energy; also for the evolution and equilibrium properties of the distribution of clusters of different sizes. Dissert. Abstr.

N76-23409 British Library Lending Div., Boston Spa (England).
HYDROGEN EMBRITTLEMENT OF PRESTRESSING STEEL
H. Bohni 1975 23 p refs Transl. into ENGLISH from Werkst.

Korros. (West Germany), v. 26, no. 3, 1975 p 199-207
(BLL-CE-Trans-6817-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The methods for testing prestressing wire are examined and improvement is sought by more extensive investigations. A deeper insight is sought into the processes taking place during hydrogen embrittlement of these materials. Author

N76-23410 British Library Lending Div., Boston Spa (England).
EXPERIMENTAL VERIFICATION OF A WORKING MODEL OF THE ROLLING PROCESS WITH THE USE OF HIGH-TEMPERATURE THERMOMECHANICAL TREATMENT
V. T. Zhadan, V. T. Gubenko, M. L. Bershtein, and M. S. Vinarskii [1975] 10 p refs Transl. into ENGLISH from Izv. VUZ Chern. met (Moscow), no. 5, 1975 p 120-123
(BLL-M-25223-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

With the use of the method of experimental planning theory an empirical check is made of a proposed mathematical model of variations in the thermomechanical parameters: strain rate, degree of reduction, post-deformation pause and rolling temperature. Regression equations are obtained, enabling the constants of the process model to be calculated. The developed mathematical model of the rolling process with high temperature thermomechanical treatment is adequate with the experimental data and can be utilized for corresponding technological calculations. The breaking strength of type 50KhGA steel according to the proposed model gives a maximum deviation between calculated and experimental values of 1%. Author

N76-23411 British Library Lending Div., Boston Spa (England).
INTENSITY OF MAGNETIZATION OF MONOCRYSTALS OF Nb-Ti ALLOYS
Yu. S. Avraamov, V. V. Baron, M. I. Bychkova, S. A. Medvedev, E. M. Savitskii, and V. A. Sein [1975] 13 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (Moscow), no. 5, 1975 p 146-151
(BLL-M-25224-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The magnetic properties of monocrystals of Nb-Ti system alloys containing 0.14, 0.35 and 54.0% Ti at 4.2 K have been investigated. The thin work-hardened surface layer forming during machining has a substantial effect on hysteresis in the superconductive state. Certain laws have been found from the magnetization curves. Author

N76-23412 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THE STRUCTURE OF A RECRYSTALLIZED FOIL PRODUCED BY THE VACUUM ROLLING OF TUNGSTEN MONOCRYSTALS
A. V. Krupin, B. L. Linetskii, N. A. Chirikov, N. N. Blokhin, and R. M. Mikhridinov [1975] 9 p refs Transl. into ENGLISH from IZV. VUZ Chern. Met. (Moscow), no. 5, 1975 p 95-98
(BLL-M-25222-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A study is made of the increase in the lamination of a tungsten foil after recrystallization. The foil was produced by rolling tungsten monocrystals in vacuum. A study of the foil structures before and after recrystallization provided a means of deducing the effect of the grain geometry and boundaries on the mechanical properties of the foil. Author

N76-23413*# State Univ. of New York, Stony Brook. Dept. of Materials Science.
ON THE KINETICS OF PACK ALUMINIZATION
B. K. Gupta, A. K. Sarkhel, and L. L. Seigle [1975] 17 p refs
(Grant NGR-33-015-160)
(NASA-CR-147232) Avail: NTIS HC $3.50 CSCL 11F

A theory of pack aluminization has been formulated by combining gaseous and solid-state diffusion rates. This theory relates the surface composition of the coating and therefore, in principle, the phase morphology and the growth rate of the coating, to pack operating parameters such as pack aluminum density, type of activator, temperature and others. Experimental data on the aluminization of unalloyed nickel in pure aluminum packs obtained to date are in good agreement with the predictions of the theory. Author

N76-23414*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TOWARDS THE COLD FORMING OF SOME HIGH-TEMPERATURE STEELS AND ALLOYS
Werner Kuppers and Dieter Schulz Washington May 1976 12 p ref Transl. into ENGLISH from DEW Tech. Berichte (Germany), v. 9, no. 2, 1969 p 313-318
(Contract NASw-2790)
(NASA-TT-F-17017) Avail: NTIS HC $3.50 CSCL 11F

A comparison is made of the cold working properties of steels, in particular of the steel NiCr 20 Ti, with those of X 5 CrNi 18 9 because more experience is available on this steel. All the steels considered, with the exception of NiCr 20 Ti, showed a strong tendency toward strain hardening so that they can be cold worked stepwise only with intermediate annealing. The limiting drawing ratio can also be achieved only when using hydraulic presses and an appropriate tool geometry. If cold working proceeds stepwise as in hammering, dishing or flanging, the materials lose their formability much earlier. Author

N76-23415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE METAL TO METAL INTERFACE AND ITS EFFECT ON ADHESION AND FRICTION
Donald H. Buckley 1976 39 p refs Presented at the Intern. Conf. on Colloids and Surfaces, San Juan, Puerto Rico, 21-25 Jun. 1976; sponsored by Am. Chem. Soc. and the Intern. Union of Pure and Appl. Chem.
(NASA-TM-X-73431; E-8584) Avail: NTIS HC $4.00 CSCL 11F

The nature of the interface, adhesion and friction properties of noble metals, platinum metals, Group IV (B) metals and transition metals were considered. The surface chemical activity of the noble and platinum metals is shown to effect metal to metal interfaces as does a valance bonding in the transition metals. With the Group IV (B) metals the degree of metallic nature of the elements is shown to effect interfacial behavior. The effect of surface segregation of alloy constituents such as silicon in iron and its influence on the metal to metal interface is discussed. In addition the effect of alloy constituents on changes in bulk properties such as transformations in tin are shown to effect interfacial adhesion and friction behavior. Author

N76-23416*# Battelle Columbus Labs., Ohio.
LOW-CYCLE FATIGUE OF TYPE 347 STAINLESS STEEL AND HASTELLOY ALLOY X IN HYDROGEN GAS AND IN AIR AT ELEVATED TEMPERATURES Final Report
Carl E. Jaske, Richard C. Rice, Richard D. Buchheit, Donald B. Roach, and Theodore L. Porfilio May 1976 110 p refs
(Contract NAS3-20078)
(NASA-CR-135022) Avail: NTIS HC $5.50 CSCL 11F

An investigation was conducted to assess the low-cycle fatigue resistance of two alloys, Type 347 stainless steel and Hastelloy Alloy X, that were under consideration for use in nuclear-powered rocket vehicles. Constant-amplitude, strain-controlled fatigue tests were conducted under compressive strain cycling at a constant strain rate of 0.001/sec and at total axial strain ranges of 1.5, 3.0, and 5.0 %, in both laboratory-air and low-pressure hydrogen-gas environments at temperatures from 538 to 871 C. Specimens were obtained from three heats of Type 347 stainless steel bar and two heats of Hastelloy Alloy X. The tensile properties of each heat were determined at 21, 538, 649, and 760 C. The continuous cycling fatigue resistance was determined for each heat at temperatures of 538, 760, and 871 C. The Type 347 stainless steel exhibited equal or superior fatigue resistance to the Hastelloy Alloy X at all conditions of this study. Author

N76-23417# Oak Ridge National Lab., Tenn.
THERMAL AND ELECTRICAL CONDUCTIVITY OF ALUMINUM
J. G. Cook, J. P. Moore, T. Matsumura, and M. P. VanderMeer Sep. 1975 23 p refs
(Contract W-7405-eng-26)
(ORNL-5079) Avail: NTIS HC $4.00

The thermal conductivity, electrical resistivity, and absolute Seebeck coefficient of pure aluminum were determined from 80 to 400 K by measuring all three properties of samples using three different techniques. Measurements were made on the purest

sample down to 20 K. The thermal conductivity has a broad plateau from 180 to 400 K and a possible minimum of 0.25 percent which is insignificant compared to the experimental errors. The same properties were measured on an aluminum alloy with a resistivity ratio of 17. Measured values of the thermal conductivity of this alloy agreed to within + or - 1 percent with calculated values using parameters obtained from the pure aluminum. Author (ERA)

N76-23418# Oak Ridge National Lab., Tenn.
EFFECTS OF PRECIPITATION ON ELECTRON DISPLACEMENT DAMAGE IN FCC ALLOYS: COPPER ALLOYS WITH RANDOM AND MODULATED MICROSTRUCTURES
R. W. Carpenter 1975 4 p refs Presented at the 4th High Voltage Electron Microscopy Conf., Toulouse Sponsored by ERDA
(Conf-750982-1) Avail: NTIS HC $4.00

Observations on the electron displacement damage behavior of spatially random precipitate in Cu-Co alloys and the modulated structure in Cu-Ti alloys are reported. A few observations of the damage structures in cellularly decomposed Cu-Ti were also made. Results show that (1) metastable quenched solid solution Cu-2wt percent Co alloys, or the same alloys aged to produce coherent Co-rich zones, do not differ greatly from elemental Cu in their behavior under 1 MeV electron irradiation. When the same alloys are aged to form longer incoherent precipitate prior to HVEM irradiation, suppression of the early small loop stage of damage occurs but voids are nucleated in both cases; (2) metastable modulated microstructures in quenched or low temperature aged Cu-4wt percent Ti alloys completely suppressed void nucleation up to fluences on the order of 50 dpa. The very fine scale microstructural changes that occurred during irradiation in the modulated Cu-wt percent Ti alloys were not resolved in detail. Author (NSA)

N76-23419# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECT OF HELIUM ON VOID SWELLING IN VANADIUM
J. L. Brimhall and E. P. Simonen 1975 5 p refs Presented at the Joint Meeting of the Am. Nucl. Soc. and the Atomic Industrial Forum, San Francisco
(Contract AT(45-1)-1830)
(BNWL-SA-5450; Conf-751101-34) Avail: NTIS HC $4.00

Little difference in void microstructural swelling of vanadium is observed when helium is injected simultaneously with a 46- or 5-MeV nickel beam as compared to no helium injection, at least at high dose rates. At lower dose rates, a strong helium effect is seen when the helium is injected prior to heavy ion bombardment. The effect of the helium is shown to be a strong function of the overall displacement damage rate. NSA

N76-23420# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECTS OF HYDROSTATIC PRESSURE ON STAGE 3 RECOVERY IN IRRADIATED AND COLD-WORKED MOLYBDENUM
H. E. Kissinger, J. L. Brimhall, and E. P. Simonen 1975 8 p refs Presented at the Intern. Conf. on Radiation Damage in Metals, Gatlinburg, Tenn.
(Contract E(45-1)-1830)
(BNWL-SA-5405; Conf-751006-11) Avail: NTIS HC $4.50

The Stage 3 recovery temperature is lowered when irradiated or cold-worked molybdenum is annealed under pressure. In irradiated samples, the pressure effect can be explained in terms of an activation volume, negative in sign, which decreases in magnitude with increasing fluence. For cold-worked molybdenum, the pressure effects are not compatible with the activation volume hypothesis. This suggests that recovery machanisms for tbe two types of damage can not he considered identical, the differences probably arising from substructure features characteristic of the damage states. Author (NSA)

N76-23421# Hanford Engineering Development Lab., Richland, Wash.
DIMENSIONAL STABILITY OF STAINLESS STEEL AS AFFECTED BY COMPOSITIONAL TRANSMUTATIONS
J. F. Bates, J. O. Schiffgens, and M. M. Paxton Aug. 1975 17 p Presented at the Intern. Conf. on Radiation Effects and Tritium Tech. for Fusion Reactors, Gatlinburg, Tenn., 1-3 Oct. 1975
(Contract E(45-1)-2177)
(HEDL-SA-951; Conf-751026-17) Avail: NTIS HC $4.00

Some effects of transmutations of Mn, Ni, Ti, and V in 316 stainless steel which would be expected in a first wall CTR application were evaluated. Based on the available data and relevant investigations, it is concluded that little or no deleterious effects on the recrystallization temperature or 1400 F tensile properties will be experienced by the steel as a result of these transmutations. The results show that a 316 stainless steel first wall of a controlled thermonuclear reactor could operate up to 30 years with no serious change in tensile properties or recrystallization temperature, although small changes in dimensions due to lattice strain would occur. If 20 percent cold worked 316 is used, the material would be thus swelling and limited in its use. No significant change in the swelling behavior of the original alloy would be expected from the solid transmutations. Author (ERA)

N76-23422# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECT OF THE FREE SURFACE ON VOID FORMATION IN ION BOMBARDED MOLYBDENUM
E. R. Bradley and J. L. Brimhall 1975 19 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Tech. for Fusion Reactors, Gatlinburg, Tenn.
(Contract E(45-1)-1830)
(BNWL-SA-5398; conf-751026-28) Avail: NTIS HC $4.00

Heavy ion bombardment is currently being considered as a technique to simulate neutron damage in CTR components, especially the first wall structure. The use of heavy ion bombardment as a neutron simulation technique has been criticized due to the damage zone being near a free surface. The purpose of the present investigation was to examine the microstructure of ion bombardment molybdenum at and below the bombardment surface utilizing transmission electron microscopy to determine the influence of the free surface on void formation. Single crystal molybdenum discs were bombardment at 1000 + or - 25 C with 5 MeV Ni(+ +) ions at surface dose rates of 0.0003, 0.0018, and 0.008 dpa/sec. The void size and density were determined as a function of depth below the bombardment surfaces. Void were observed within 100 A of the bombardment surfaces and no significant indications of surface-related effects were observed. The variations in void size and density are discussed in terms of the total dose and dose rate at the various regions of examination and the results compared with existing ion bombardment and neutron irradiation data. Author (ERA)

N76-23423# Battelle Pacific Northwest Labs., Richland, Wash.
KINETIC STABILITY AGAINST VOID COARSENING IN MOLYBDENUM
E. P. Simonen and J. L. Brimhall 1975 15 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Tech. for Fusion Reactors, Gatlinburg, Tenn., 1 Oct. 1975
(Contract AT(45-1)-1830)
(BNWL-SA-5376; Conf-751026-27) Avail: NTIS HC $4.50

The measured rate of increase of void size in molybdenum with annealing time is found to be slower than expected from the Wagner analysis of diffusion-controlled coarsening. The Wagner theory of surface-reaction-control is also compared with ripening data. The determined surface kinetic parameters are compared with vacancy diffusivities and are found to be not unrealistic. A measured decrease in void volume during annealing indicates that total void volume is not conserved. These observations support the conclusion that void coarsening is influenced by more than one rate controlling mechanism. A numerical solution to the void annealing problem is obtained and the specific role of volume diffusion, surface kinetics, and annealing of vacancies to sinks other than voids is calculated. Author (NSA)

N76-23424# Pennsylvania State Univ., University Park. Dept. of Materials Science.
A MEANS OF INHIBITING HYDROGEN ENTRY INTO STEEL
S. S. Chatterjee and H. W. Pickering Nov. 1975 11 p Presented at the Intern. Conf. on Effect of Hydrogen on Behavior of Mater., Jackson Lake Lodge, Moran, Wyo., 7-17 Sep. 1975
(Contract N00014-75-C-0264)
(AD-A018343; TR-75-06) Avail: NTIS CSCL 11/6

When the cathodic charging current density is switched from 2mA/sq cm to 100 mA/sq cm, the permeation current through iron alloy sheet specimens at first rises as expected, but then suddenly decreases. If the current is switched off for approx. 0.5hr, the greatest inhibition of hydrogen entry is observed. The inhibition is only observed when the solution contains chloride ions and cathodic poisons like As (3+), Sn(4+), S(2+), or I(+). Author (GRA)

N76-23425# Army Materials and Mechanics Research Center, Watertown, Mass.
THE PARTITIONING OF IMPURITY ELEMENTS IN IRON-CARBON ALLOYS Final Report
Weily F. Chiao, Gordon A. Bruggeman, and Eric B. Kula Sep. 1975 49 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A018226; AMMRC-TR-75-19) Avail: NTIS CSCL 11/6

The partitioning at 600 C of the elements tin, phosphorus, silicon, antimony, and arsenic between the ferrite and carbide phases was investigated in Fe-C-X alloys, where X is one of the above elements. These elements are all known to increase the susceptibility for temper brittleness in steels and are suspected of playing a similar role in the phenomenon of tempered martensite embrittlement or 500 F embrittlement. The procedures of metallographic examination, electron microprobe analysis, ferrite lattice parameter measurement, and chemical analysis and crystal structure determination of extracted carbides were employed in the study. It was determined that of the above elements only tin and phosphorus appear to partition to the carbide phase, tin apparently forming a ternary carbide. The remaining elements silicon, antimony, and arsenic partition to ferrite, thus providing a condition conducive to the accumulation of these impurities on the ferrite side of ferrite/carbide interfaces during tempering. By virtue of its more potent solid solution strengthening effect in ferrite, one might, therefore, anticipate a greater embrittling tendency from the impurity element antimony, a prediction borne out by experiment. Solubility limits, distribution coefficients, and other phase relations were determined during the course of this study. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-23426* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THREE-COMPONENT CERAMIC COATING FOR SILICA INSULATION Patent
Alexander Pechman (LMSC, Sunnyvale, Calif.) and Robert M. Beasley, inventors (to NASA) (LMSC, Sunnyvale, Calif.) Issued 4 May 1976 6 p Filed 24 Jun. 1974 Supersedes N74-30004 (12 - 19, p 2314) Sponsored by NASA
(NASA-Case-MSC-14270-2; US-Patent-3,955,034; US-Patent-Appl-SN-482105; US-Patent-Class-428-332; US-Patent-Class-106-54; US-Patent-Class-427-376; US-Patent-Class-427-379; US-Patent-Class-427-380; US-Patent-Class-427-402; US-Patent-Class-428-428; US-Patent-Class-428-450; US-Patent-Class-428-538; US-Patent-Class-428-920) Avail: US Patent Office CSCL 11B

Low density, fibrous, rigid, silica insulations are rendered impervious to moisture by application of a ceramic glaze coating comprising a silica barrier layer, an emissivity layer comprising a high silica glass component, an emissivity agent, an overglaze layer comprising a high silica glass component, and a borosilicate glass component. The resulting three-layered ceramic glaze laminate adhered to the fibrous silica insulation provides a moisture-impervious insulating material which exhibits a high emissivity and is resistant to delamination and spalling at repeated cycles of thermal shock.
Official Gazette of the U.S. Patent Office

N76-23427 British Library Lending Div., Boston Spa (England).
SERVICE CONDITIONS OF REINFORCED CONCRETE POLES DURING LONG-TERM EARTH FAULTS
J. Arciszewski, E. Reich, and J. Gackowski [1975] 8 p refs Transl. into ENGLISH from Energetyka (Poland), v. 28, no. 3, Mar. 1974 p 88-91
(BLL-OA-Trans-2010-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Reinforced concrete poles used in transmission line construction are studied. Disadvantages of their use examined include: deterioration of line insulator service conditions; and adverse effect of earth fault currents on the poles particularly on their underground parts. No damage to the poles was noted from large but short-duration lightning or short-circuit currents. Relatively small currents, but flowing over a long period, were observed to be more harmful, because they can cause significant damage to the underground part of a pole. The effect of soil layer thickness as an insulator is discussed. Author

N76-23428 British Library Lending Div., Boston Spa (England).
THE USE OF CONCRETE POLES IN MEDIUM AND LOW VOLTAGE NETWORKS [IN INTERNATIONAL PRACTICE]
S. Moszczynski [1975] 7 p ref Transl. into ENGLISH from Energetyka (Poland), v. 22, no. 12, Dec. 1968 p 406-409
(BLL-OA-Trans-2009-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Tendencies and problems in most of the European countries using concrete poles are summarized. The reasons for use, methods of production, types of equipment etc., and faults of the poles are discussed. Author

N76-23429 Akron Univ., Ohio.
TEAR STRENGTH AND ENERGY EXPENDED IN DEFORMATION OF POLYETHYLENE Ph.D. Thesis
Dan-Sam Chiu 1975 211 p
Avail: Univ. Microfilms Order No. 76-10075

Tear experiments were done with both quenched and annealed high density polyethylene samples. Under all testing conditions, the annealed sample was found to have a lower tear strength, less work of hysteresis and higher yield stress. The difference in tear strengths of the annealed and quenched samples is attributed to the difference in the yielding and ultimate tensile properties of the samples, which is presumably due to the different crystallinity of these samples. Dissert. Abstr.

N76-23430 Akron Univ., Ohio.
STRESS RELAXATION AND STRAIN RECOVERY STUDIES OF ELASTOMERS Ph.D. Thesis
Lie Khong Djiauw 1975 162 p
Avail: Univ. Microfilms Order No. 76-10076

Stress relaxation and strain recovery studies were carried out in four unvulcanized elastomers. The relation between the rate of stress relaxation and deformation of some crosslinked, filled and block polymers was also explored. Dissert. Abstr.

N76-23431 Utah Univ., Salt Lake City.
PYROLYSIS AND THERMAL DEGRADATION OF RIGID-URETHANE FOAMS Ph.D. Thesis
M. S. Ramakrishnan 1975 194 p
Avail: Univ. Microfilms Order No. 76-9813

An experimental program was designed and carried out to obtain a better understanding of the thermal decomposition processes pertaining to rigid-urethane foams. A series of low-density rigid-urethane foams, incorporating the selected fire retardants, were prepared by the one-shot process. All model foams were characterized using infrared spectroscopy and elemental analysis. Each of the model polymer systems were pyrolyzed at several temperatures in both inert and oxidative environments. The products resulting from thermal decomposition were separated using a variety of gas-chromatographic columns and identified utilizing an interfaced computerized mass spectrometer system. The role played by oxygen in phase weight losses was investigated. The role played by the fire retardant in altering the nature of volatile products was investigated under both slow and fast heating conditions. Dissert. Abstr.

N76-23432 Northwestern Univ., Evanston, Ill.
ANALYSIS OF BRANCHED POLYMERS: AUTOMATIC VISCOMETRY COMBINED WITH GEL PERMEATION CHROMATOGRAPHY Ph.D. Thesis

Won Sik Park 1975 176 p
Avail: Univ. Microfilms Order No. 76-11916

In this work, the intrinsic viscosity of each fraction eluted from the GPC is determined automatically with a highly accurate on-line viscometer. Proper handling of such information can provide in principle the true molecular weight distribution of the sample as well as the average branching frequency as a function of molecular weight. The procedures and underlying theories were tested by measurements on three types of branched polymers: a whole styrene-divinylbenzene copolymer and several of its fractions, polybutadienes cross-linked by high energy radiation, and polyvinyl acetates prepared by free radical polymerization to various conversions. Dissert. Abstr.

N76-23433 Ohio State Univ., Columbus.
TIME DEPENDENT BEHAVIOR OF A VISCOELASTIC POLYMERIC MATERIAL Ph.D. Thesis
Krishman Ravi Varman Pandalai 1975 181 p
Avail: Univ. Microfilms Order No. 76-10022

A theory based on a kinetic model to explain the non-Newtonian behavior of high molecular weight polymeric solutions has been developed. The theory had been compared with experimental data by previous researchers for stress growth at constant shear rate, shear growth at constant shear stress, stress relaxation and normal stress difference. The theoretical and experimental amplitude ratios and phase shifts have been calculated for 38.5% by weight solution of polymethylmetharylate in diethylphthalate. Using the same constants and parameters, stress growth at constant shear rate and stress relaxation were analyzed. It was found that the theory could predict all three types of experiments reasonably well, but not with all constants being the same. The maximum deviation between the experimental data and predicted values occurred at high shear rates in the stress growth experiments when overshoot occurs. With the completion of this work on oscillatory deformation, it has been shown that the theory based on the kinetic model has the potential to represent equilibrium and transient behavior of viscoelastic polymeric materials. Dissert. Abstr.

N76-23434 British Library Lending Div., Boston Spa (England).
INTERNAL SURFACES AND ADSORPTION BEHAVIOUR OF MACROPOROUS ION EXCHANGERS
F. Martinola et al 1975 18 p refs Transl. into ENGLISH from VGB Kraftwerkstech. (West Ger.), vol. 55, no. 1, Jan. 1975 p 40-47
(BLL-CE-Trans-6749-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The chemical and physical properties of macroporous styrene ion exchange resins used in water treatment were studied (their polymer chemistry and ability to remove large organic ions). The manufacturing of these resins is briefly considered. Methods for determining porosity in the resins, such as chemically flushing the resins in isopropanol to remove water, are examined. Results are presented and discussed for ion exchange tests performed on resins having the same porosity, but varying chemical structure, and resins having the same chemical structure, but varying porosities. The resins were evaluated on their ability to remove a mixture of organic substances, specifically, humic acid, lignin, sulphonic acid, and molasses solution. J.R.T.

N76-23435*# New Mexico Highlands Univ., Las Vegas. Dept. of Chemistry.
APPLICATION OF BICYCLIC AND CAGE COMPOUNDS Final Report
Ronald D. Clark and Bennie S. Archuleta 30 May 1976 347 p refs
(Grant NsG-804)
(NASA-CR-147934) Avail: NTIS HC $10.00 CSCL 11I

The results of a literature survey of the field of bicyclic and cage compounds were presented, with the objective of identifying those types of compounds with unusual physical and chemical stability, and determining what practical applications have been found for these compounds. Major applications have been as polymers, polymer additives, medicinals, and pesticides. Lesser applications have included fuels, fuel additives, lubricants, lubricant additives, and perfumes. Several areas where further work might be useful were also outlined; these are primarily in the areas of polymers, polymer additives, medicinals, and synthetic lubricants. Author

N76-23436*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL SHOCK AND EROSION RESISTANT TANTALUM CARBIDE CERAMIC MATERIAL Patent Application
Leroy Honeycutt, Jr. (N. C. State Univ.) and Charles R. Manning, Jr., inventors (to NASA) (N. C. State Univ.) Filed 1 Apr. 1976 12 p Sponsored by NASA
(NASA-Case-LAR-11902-1; US-Patent-Appl-SN-672695) Avail: NTIS HC $3.50 CSCL 11B

Ceramic tantalum carbide artifacts with high thermal shock and mechanical erosion resistance are fabricated by incorporating tungsten-rhenium and carbon particles in a tantalum carbide matrix. The mix is sintered by hot pressing to form the ceramic article which has a high fracture strength relative to its elastic modulus and thus has an improved thermal shock and mechanical erosion resistance. The tantalum carbide is preferable less than minus 100 mesh, the carbon particles are preferable less than minus 100 mesh, and the tungsten-rhenium particles are preferable elongate, with a length to thickness ratio of at least 2/1. Tungsten-rhenium wire pieces are suitable as well as graphite particles. NASA

N76-23437*# Monsanto Research Corp., St. Peters, Mo.
DETERMINATION OF A DEFINITION OF SOLAR GRADE SILICON Quarterly Report, 1 Oct. - 31 Dec. 1975
Dale E. Hill and Henry W. Gutsche 31 Dec. 1975 30 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954338)
(NASA-CR-147916; QR-1) Avail: NTIS HC $4.00 CSCL 11D

A definition of solar grade silicon was determined by investigating the singular and the combined effect of the impurities usually found in metallurgical grade silicon on solar cell device performance. The impurity matrix was defined by Jet Propulsion Laboratory Technical Direction Memorandum. The initial work was focussed on standardizing the solar cell process and test procedure, growing baseline crystals, growing crystals contaminated with carbon, iron, nickel, zirconium, aluminum and vanadium, solar blank preparation, and material characterization. Author

N76-23438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF TREATING THE SURFACE OF A GLASS MEMBER Patent Application
Stephen H. Rice, Rodney S. Spencer, and Charles M. Fleetwood, Jr., inventors (to NASA) Filed 3 May 1976 20 p
(NASA-Case-GSC-12110-1; US-Patent-Appl-SN-682435) Avail: NTIS HC $3.50 CSCL 11B

A method is presented of treating a surface of a glass member intended to abut a transparent element for disrupting the light interference fringes formed therebetween. The method involves the following steps: (1) grinding the surface to form irregularities thereon; (2) bathing the surface with an aqueous solution containing between substantially 41.3 percent and 45.7 percent by volume of sulfuric acid and between substantially 54.3 percent and 58.7 percent by volume of hydrofluoric acid for a time sufficient to polish the irregularities until the glass member is about 90 percent light transmissive; and (3) washing the glass member with a liquid having a temperature substantially lower than the temperature of the aqueous solution for preventing further reaction between the aqueous solution and the surface. NASA

N76-23439# Ames Lab., Iowa.
TEMPERATURE DEPENDENCE OF RESISTIVITY OF THIN FILM SAMPLES OF CHALCOGENIDE GLASSES M.S. Thesis
A. K. Kulkarni Oct. 1975 53 p refs
(Contract W-7405-eng-82)
(IS-T-694) Avail: NTIS HC $5.75

Results of studies on thin film chalcogenide glasses are presented. It was found that the values of activation energy for As-Te-Ge samples obtained from RF sputtering lie close to the values of activation energy for bulk and evaporated samples. Two models have been suggested to explain the sharp change in activation energy at 285 + or - 10 K. The kink (change in

slope) may be interpreted in the plot of resistivity versus 1,000/T as the result of a change in the conduction mechanism for band conduction to hopping conduction. Alternatively, the change in slope may be interpreted as the result of a slight change in structure at the glass transition. In order to reach a conclusion, the X-ray diffraction patterns of the samples at different temperatures might be observed. It is believed that a change in the structure, if it exists, should somehow manifest itself in X-ray diffraction patterns observed at different temperatures.
Author (ERA)

N76-23440# Bendix Corp., Kansas City, Kans.
MOLDING CHARACTERISTICS OF THERMOPLASTIC FOAMS
C. L. Walter Oct. 1975 16 p ref
(Contract AT(29-1)-613)
(BDX-613-1414-Rev) Avail: NTIS HC $4.00

Rheological and processing characteristics for three injection-moldable foam systems were evaluated. Two polycarbonates containing 6 percent glass fiber and a polyester containing 33 percent glass fiber were studied. Results indicate that foam parts having densities approximately 50 percent of the specific gravity of the base resins can be produced on existing injection molding equipment. Author (ERA)

N76-23441# California Univ., Livermore. Lawrence Livermore Lab.
EQUATION OF STATE OF PLASTICS: POLYSTYRENE AND ITS FOAMS
Francis H. Ree 25 Aug. 1975 30 p refs
(Contract W-7405-eng-48)
(UCRL-51885) Avail: NTIS HC $4.00

New equation of state (EOS) data is presented for polystyrene, covering densities between 1 and 1 million kg/cu m and temperatures to 6000 eV. Different physical processes occurring at various ranges of densities and temperatures are discussed. The procedure used here is to combine several of the latest theoretical models which can describe these processes in order to generate EOS data over the entire density and temperature range described above. Comparison with experimental Hugoniots supports the general usefulness of such a procedure. Further improvements that can be made in the theoretical models are discussed. Author (ERA)

N76-23442# Sandia Labs., Albuquerque, N.Mex.
COMPOSITION AND STRUCTURE OF A STRESS RELIEVING REMOVABLE EPOXY RESIN
C. V. Carter Nov. 1975 59 p refs
(Contract AT(29-1)-789)
(SAND-75-0411) Avail: NTIS HC $5.50

The aqueous modification of polyol modified anhydride cured diglycidyl ether of bisphenol A exhibits properties of a brittle solid when subjected to an impulse stress, and properties of a viscous fluid when subjected to a steady state stress. This behavior is markedly different from the nonaqueous system. Early attempts to understand the nature of the change in properties and the physical mechanism involved were not completely successful. It was postulated that the accelerated ring opening reaction facilitated the formation of a noncrosslinked low molecular weight polymer. In an attempt to confirm this hypothesis, the elucidation of the structure was undertaken. High-speed gel permeation chromatography indicated two things: (1) the material is noncrosslinked because it dissolves in solvent, and (2) the highest molecular weight material formed is approximately 2500.
Author (ERA)

N76-23443# ARO, Inc., Arnold Air Force Station, Tenn.
AFML CERAMIC NOSETIP ABLATION TEST Final Report, Feb. - Apr. 1975
J. B. Patton AEDC Dec. 1975 65 p refs
(AF Proj. 7381; ARO Proj. P41L-19A)
(AD-A018542; AEDC-TR-75-115; ARO-PWT-TR-75-87) Avail: NTIS CSCL 16/3

Eight ablation test runs were made in an arc-heated, free-jet facility using air as the test fluid. These tests were made to study the effects of hyperthermal conditions on ablative materials of various compositions. The study was accomplished at Mach numbers 2.0 and 2.3 with measured reservoir pressures ranging from 78.2 to 142.2 atm and total bulk enthalpies from 2,120 to 2,416 Btu/lb. For the above conditions, model stagnation pressures ranged from 42.9 to 92.8 atm. The models consisted of sphere-cone and cone-cone configurations. A pressure probe was used to obtain model stagnation pressure, and a multichannel calorimeter model was used to obtain heat-transfer data for flow calibration. Author (GRA)

N76-23444# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/Materials Directorate.
ENVIRONMENTAL COMPATIBILITY OF REINFORCED PLASTICS
James L. Parham and Jerry W. Vickers 25 Jul. 1975 51 p
(DA Proj. 1T1-62106-A-331)
(AD-A018280; RL-76-1) Avail: NTIS CSCL 11/4

A study was made of the effects of fabrication variables on environmental degradation of fiberglass laminates. Glass temperature, resin temperature, cure temperature, and cure times were evaluated. Evaluations were at five test temperatures and after six environmental exposure times. The four variables studied had only minor effects on laminate degradation. GRA

N76-23445# Air Force Systems Command, Wright-Patterson AFB, Ohio.
RESISTANCE OF ELECTROTECHNICAL MATERIALS TO IONIZING RADIATION. PHASE 2: BEHAVIOR OF MATERIALS IN AN INFRARED ENVIRONMENT
Jan Berr 26 Nov. 1975 16 p refs Transl. into ENGLISH from EKT, Elektroizolacna a Kablova Tech. (Czechoslovakia), v. 27, no. 2, 1974 p 103-110.
(AD-A018538; FTD-ID(RS)I-2186-75) Avail: NTIS CSCL 11/9

In the first part polymers were divided into two groups according to the nature of their predominant activity under the influence of radiation, into polymers which are predominantly cross-linking or degrading. The activity mentioned proceeds even at relatively small doses, although doses up to over 0.1 Mrad are necessary to produce substantial changes. In reviewing the resistance of some materials to radiation, mention should always be made of the basis for the criteria according to which resistance is determined and under what conditions the polymer radiation occurred. The choice of a suitable criterion is very important, for in some polymers radiation resistance may differ by multiples of thousands from different points of view. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N76-23446# Southwest Research Inst., San Antonio, Tex.
DETERMINING THE POTENTIAL OF RADIOFREQUENCY RESONANCE ABSORPTION DETECTION OF EXPLOSIVES HIDDEN IN AIRLINE BAGGAGE Final Report
W. L. Rollwitz, J. D. King, and S. D. Shaw Oct. 1975 101 p
(Contract DOT-FA75WA-3635)
(AD-A022111/9; SwRI-15-4225) Avail: NTIS HC $5.50 CSCL 19/1

The potential of radiofrequency resonance absorption spectroscopy techniques for detecting quantities of specific explosives in checked airline luggage was investigated. The RRAS techniques considered in this study included nuclear magnetic resonance, electron spin resonance and nuclear quadrupole resonance. It was found that all the explosives, except black powder, could be detected by NMR and that the NMR response from explosives could be separated from the response produced by other materials likely to be found in luggage. It was also found that black powders and smokeless powder could be detected by ESR but none of the other explosives produced an ESR response. NQR was found useful only for the detection of the RDX base explosive C-4 but even this material could be more sensitively detected by NMR. A magnet and detection coil

through which baggage with cross sectional dimensions up to 14 inch x 24 inch could be passed for inspection was constructed and tested. The results were sufficient to demonstrate the basic feasibility of using NMR for detection of responses from materials in the large volumes required to inspect checked baggage.
Author

N76-23447# Addis Translations International, Portola Valley, Calif.
ON THE TRAIL OF NEW FUELS, ALTERNATIVE FUELS FOR MOTOR VEHICLES
Sep. 1975 395 p refs Transl. into ENGLISH from Neuen Kraftstoffen auf der spur, Alternative Kraftstoffe fuer Kraftfahrzeuge (Germany), 1974 p 1-282 Sponsored by ERDA
(UCRL-Trans-10879) Avail: NTIS HC $22.75

Motor vehicle alternate fuels are studied which will alleviate the pollution and supply problems presented by the use of gasoline. Topics include: (1) an index of researchers; (2) properties of methanol and methyl fuel; (3) availability of the raw materials; (4) production of methanol; (5) ocean transport, storage, and inland distribution; (6) vehicle requirements and safety problems; (7) methanol operation of conventional vehicles; (8) methanol operation of other propulsion systems; (9) fuel cells and gas generators; and (10) a list of references. Likely prospects for alternate fuels are methanol in the short and intermediate term and hydrogen in the long term. For both these fuels, the manufacture does not depend on oil, combustion engines of known construction can be used, and these fuels can be substituted for gasoline in steps. ERA

N76-23448# Rockwell International Corp., Canoga Park, Calif.
THE 100-GPM ELECTROKINETIC FUEL DECONTAMINATOR Final Report
L. L. Prem, L. R. McCoy, and V. C. Davis 15 May 1975 72 p refs
(Contract DAAK02-72-C-0640)
(AD-A018465; AI-75-8) Avail: NTIS CSCL 21/4

Investigative work carried out under Contract DAAK 02-69-C-0643, demonstrated that high voltage alternating electric fields could de-stabilize water-in-fuel emulsions using No. 2 Diesel as the test fuel. Other fuels such as JP-5 and gasoline were also successfully treated in this manner. A design scale-up was made from the 10-gpm breadboard model built and operated previously to a 100-gpm pilot model, improved de-entrainment means, and automatic water drain control. Implicit in the scale-up design was modification of electrode structure to permit more practical means of fabricating the larger electrodes. This matter together with de-entrainment studies and automatic drain provisions are described. Initial design studies indicated that two concepts offered individual advantages. The use of separate vessels for the electrocoalescer and filter units offered simplicity of design. The unit constructed in this manner is described. The second design in which both the electrocoalescer and filters were housed in a single vessel provided a more compact arrangement. The unit built in accordance with this design (integral unit) is described. Test results with the two vessel designs are summarized. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-23449 British Library Lending Div., Boston Spa (England).
MEASUREMENT ENGINEERING
J. Schiele 1975 16 p refs Transl. into ENGLISH from Brennstoff-Waerme-kraft (West Ger.), vol. 27, no. 4, 1975 p 182-185
(BLL-NEL-TT-2634-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The continuing development of measurement engineering in industrial manufacturing processes, as an essential precondition for introducing automation, and for economic and quality control requirements are briefly discussed. Areas covered are: mechanical measurement quantities, temperature and moisture measurement, analysis engineering and environmental protection, electrical measurement quantities, machine measurement engineering, and large plant instrumentation. A.L.

N76-23450# Committee on Science and Technology (U. S. House).
PROBLEMS AND LEGISLATIVE OPPORTUNITIES IN THE BASIC MATERIALS INDUSTRY
Washington GPO 1975 155 p refs Rept. for Subcomm. on Sci., Res., and Technol. of Comm. on Sci. and Technol., 1st Sess., Nov. 1975 Prepared by Library of Congr., Sci. Policy Res. Div.
(GPO-60-444) Avail: Subcomm. on Sci., Res., and Technol.

To illustrate the problems confronting the basic materials industries in the United States, efforts undertaken by a number of other countries to improve the industrial competitiveness of their raw materials industries are compared and the impact of international technology transfer in these industries is assessed. The current situation of four U.S. basic industries is described, and such issues as management/market problems, governmental policies, and educational trends are addressed. Legislative opportunities to assist these industries by encouraging innovation and the successful commercialization of new products and processes are identified. Author

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-23451 British Library Lending Div., Boston Spa (England).
THE 8.448 Mbit/s PCM TRANSMISSION OVER SYMMETRICAL TWISTED TWIN-PAIRS IN PCM WIDEBAND LOCAL TRAFFIC CABLES
Reginhard Pospischil and Josef Domer 10 Nov. 1975 12 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (Brunswick), v. 27, no. 8, 1974 p 297-301
(BLL-Trans-3254-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The results of an 8.44 Mbit/s test transmission over a bundle-shielded cable having five twisted twin pairs per bundle with a conductor cross-section of 0.9 mm are discussed as designated for a PCM wideband local traffic cable. They show that by transmitting with a peak power of 50 mW (the power of a pseudoternary continuous 1 signal) and taking the necessary safety margins for practical operation fully into consideration, a repeater section attenuation of 77 dB can be realized at the half bit frequency of 4.224 Mbit/s. This corresponds to a repeater spacing of 4.3 km. The measured cross-talk values show further that the cable in its existing form is also suitable for the transmission of information at 34 Mbit/s from a PCM tertiary multiplex system with a repeater spacing of 2 km if the transmitting power is increased to 100 mW. Author

N76-23452 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PREDICTION OF MODULATION DETECTABILITY THRESHOLDS FOR LINE-SCAN DISPLAYS Ph.D. Thesis
Robin Lee Keesee 1976 202 p
Avail: Univ. Microfilms Order No. 76-11268

An experiment was conducted to determine modulation detectability threshold functions for medium to high resolution low-light-level television systems. Specially, the psychophysical method of adjustments with target grating modulation as the dependent variable was employed in an experiment where, at each of 10 combinations of video line and video noise passband, each of 7 subjects received 2 replications at every combination of 10 spatial frequencies, 2 target orientations, and 5 noise amplitudes. Line rates were 525, 945, and 1,225 lines per frame; the spatial frequencies were between 1 and 20 c/deg; and the gratings were oriented vertically (perpendicular to the video raster) and horizontally (parallel to the raster). Using a step-wise regression technique to evaluate candidate variables, a model predicting the modulation threshold as a function of the other variables was developed for each grating orientation.
Dissert. Abstr.

N76-23453 Tennessee Univ., Knoxville.
ANALYSIS OF CONOPULSE RADAR SYSTEMS Ph.D. Thesis
Hajime Sakamoto 1975 199 p
Avail. Univ. Microfilms Order No. 76-11088

The purpose was to analyze the conopulse tracking radar system which is a hybrid of monopulse and conical scan tracking radar systems. Two methods, the monopulse-conical scan method and the conical scan-monopulse method, were developed to extract the angle-error signals in this system. The extraction of the angle-error signals for small pattern squint and target angle was first described. The two different approaches were applied to the analyses under this condition. Since the angle-error signals depended on the antenna patterns used, they were expanded into the Maclaurin's series. It was called the Maclaurin series method. Each pattern was expanded into the suitable series for the practical pattern representation as alternate approach. These series were used for the extraction of the angle-error signals.
Dissert. Abstr.

N76-23454 Ohio Univ., Athens.
AN ADAPTIVE DELTA MODULATION SCHEME WITH LARGE DYNAMIC RANGE ANALYSIS AND APPLICATIONS Ph.D. Thesis
Michael Joseph OConnor 1975 166 p
Avail: Univ. Microfilms Order No. 76-10313

The problem considered for this research was the analysis of a new adaptive delta modulation technique. As a result of this research two new and original adaptive delta modulators were proposed. These two circuits have been labeled double integration adaptive delta modulation and triple integration adaptive delta modulation. These circuits represent a considerable improvement over existing linear delta modulation (LDM) in both dynamic range and peak signal-to-noise ratio. The most significant contribution to the state-of-the-art is the proposed adaptive delta modulators and the related theoretical analysis. The theoretical analysis presented for the proposed ADM circuits represents the first signal-to-noise determination for adaptive delta modulations. The circuits described and investigated in this work can be used as an accurate and cheap analog-to-digital converter. The theoretical derivations allow the communication designer to perform various tradeoff studies in a relatively easy manner. Another significant result was the simulation of ADM and LDM performance. The phase error correction, critical to matching theoretical results with simulation performance has not been previously presented in either ADM or LDM literature. Two areas of future work are identified - overshoot suppression and optimum reset logic. These two areas limit the achievement of theoretical performance but do not affect the significant improvement in performance.
Dissert. Abstr.

N76-23455 Notre Dame Univ., Ind.
QUASI-COHERENT DETECTION OF DIFFERENTIALLY ENCODED MPSK SIGNALS Ph.D. Thesis
Mark Francis McClernon 1976 137 p
Avail. Univ. Microfilms Order No. 76-10518

A method of detecting differentially encoded N-ary phase shift keyed signals is presented. This method yields probabilities of error that are as low as those of coherent detection but uses a far simpler and more flexible detector. It provides a gain in signal-to-noise ratio over standard differentially coherent detection that ranges up to 3 db depending on the number of messages per baud. The structure of the quasi-coherent detector is described. As with differentially coherent detection, it is assumed that the receiver knows message timing and carrier frequency; there is however, no need for a suppressed carrier tracking loop as there is with coherent detection. Quasi-coherent detection forms an estimate of the remainder of the phase offset between the transmitter and receiver when it is divided by 2 pi N.
Dissert. Abstr.

N76-23456 Southern Methodist Univ., Dallas, Tex.
ADAPTIVE DIGITAL SIGNAL PROCESSING WITH APPLICATIONS TO COMMUNICATION FILTERING Ph.D. Thesis
Hussein Sedky El-Ghoroury 1975 114 p
Avail: Univ. Microfilms Order No. 76-10394

Several advantages are observed in designing recursive digital filters according to a class of frequency transformation that is directly incorporated in the filter structure. In particular, it is shown that in applying, such a transformation on wave digital filters results in the development of a Universal digital filter structure that can be modified to achieve any desired frequency specifications by simply changing the value of the filter multipliers without altering the overall structure. Thus, this class of digital filters is useful for adaptive digital filtering applications. As one of the potential applications of the developed online identification procedure, an adaptive digital demodulation scheme suitable for FM demodulation is described. The proposed digital demodulation scheme is based upon identifying the digital instantaneous frequency of a uniformly sampled FM signal. The performance of the digital demodulation scheme is demonstrated and compared with that of conventional FM discriminator for sinusoidal modulating signal.
Dissert. Abstr.

N76-23457 British Library Lending Div., Boston Spa (England).
A FREQUENCY DIVISION MULTIPLEX SYSTEM FOR VIDEOPHONE TRANSMISSION
V. Micic, Alain Cabet, and Jean Coulon [1975] 20 p Transl. into ENGLISH from L'Onde Electrique (France), 55, no. 2, Feb. 1975 p 108-116
(BLL-Trans-3293-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

After showing the reasons leading to the realization of a 16 channel FDM system for videophone transmission over coaxial lines, the theoretical background directing its conception is stated. Afterwards, the principle of operation of various units and an electrical description of the equipment are presented.
Author

N76-23458 British Library Lending Div., Boston Spa (England).
MEASUREMENT OF CROSSTALK ON BALANCED PAIR CABLES OPERATING IN A DIGITAL MODE
J. Boulvin [1975] 32 p refs Transl. into ENGLISH from Cables et Transmission (France), v. 29, no. 2, Apr. 1975 p 194-212
(BLL-Trans-3286-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Because of the widespread use of pulse code modulation systems the question has arisen of using the existing audiofrequency cables for the transmission of a certain number of links, both directions of transmission being in the same cable; however, it is absolutely necessary to know certain electrical characteristics of these cables (impedance, pair attenuation, crosstalk between pairs) at various frequencies. The impedance and attenuation can be obtained with the aid of known equipment and measurement procedures. Moreover, in order to determine what percentage of pairs can be used for the transmission of digital systems with different types of cables, systematic measurements of near-end crosstalk attenuation and signal to far-end crosstalk ratio at several frequencies are necessary. However, these measurements are lengthy (only one interfering/interfered-with couple can be measured at a time) and their interpretation requires difficult calculations based on more or less valid hypotheses. Consequently, a method of measurement in digital mode was perfected. This method consists of transmitting pseudo-random sequences simultaneously over several interfering pairs and measuring the effective noise voltage received at a network output simulating the amplifiers equalizer of a repeater generator. Measurements done in accordance with this method are quick, and of easy interpretation.
Author

N76-23459 British Library Lending Div., Boston Spa (England).
SOME ANALYTICAL RELATIONS BETWEEN PULSE NOISE PARAMETERS AND ERROR PROBABILITY IN DIGITAL TRANSMISSION
J. Lubacz [1975] 18 p refs Transl. into ENGLISH from Rozpr. Elektrotech. (Poland), v. 21, no. 1, 1975 p 153-166
(BLL-Trans-3296-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

A general analytical model of pulse noise which relates to pulse noise parameters with error probability in digital transmission was introduced. This model is then modified to illustrate a specific case which is a compromise between the general case and the practical applicability of the results obtained. The deduced analytical relationship can be used as a basis for developing an empirical method of estimating the probability of error due to pulse noise.
Author

N76-23460*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 0.4 TO 10 GHz AIRBORNE ELECTROMAGNETIC ENVIRONMENT SURVEY OF USA URBAN AREAS
Ralph E. Taylor and James S. Hill (RCA Service Co., Springfield, Va.) May 1976 17 p refs Proposed for presentation at IEEE Intern. Symp. on Electromagnetic Compatibility (EMC), Session 2B, Washington, D. C., 13-15 Jul. 1976 Submitted for publication
(NASA-TM-X-71112; X-952-76-76) Avail: NTIS HC $3.50 CSCL 20N

An airborne electromagnetic-environment survey of some U.S. metropolitan areas measured terrestrial emissions within the broad frequency spectrum from 0.4 to 10 GHz. A Cessna 402 commercial aircraft was fitted with both nadir-viewing and horizon-viewing antennas and instrumentation, including a spectrum analyzer, a 35 mm continuous film camera, and a magnetic tape recorder. Most of the flights were made at a nominal altitude of 10,000 feet, and Washington, D. C., Baltimore, Philadelphia, New York, and Chicago were surveyed. The 450 to 470 MHz land-mobile UHF band is especially crowded, and the 400 to 406 MHz space bands are less active. This paper discusses test measurements obtained up to 10 GHz. Sample spectrum analyzer photograhs were selected from a total of 5,750 frames representing 38 hours of data. Author

N76-23461*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
SHUTTLE/SPACELAB MMAP/ELECTROMAGNETIC ENVIRONMENT EXPERIMENT PHASE B DEFINITION STUDY Preliminary Report, 26 Jun. - 26 Nov. 1975
J. B. Horton, M. S. Afifi, G. A. Dorfman, and H. Jankowski Nov. 1975 132 p refs
(Contract NAS5-22469)
(NASA-CR-144754; Rept-1J42-110) Avail: NTIS HC $6.00 CSCL 20N

Progress made during the first five months of the Phase B definition study for the MMAP/Electromagnetic Environment Experiment (EEE) was described. An antenna/receiver assembly has been defined and sized for stowing in a three pallet bay area in the shuttle. Six scanning modes for the assembly are analyzed and footprints for various antenna sizes are plotted. Mission profiles have been outlined for a 400 km height, 57 deg inclination angle, circular orbit. Viewing time over 7 geographical areas are listed. Shuttle interfaces have been studied to determine what configuration the antenna assembly must have to be shared with other experiments of the Microwave Multi-Applications Payload (MMAP) and to be stowed in the shuttle bay. Other results reported include a frequency plan, a proposed antenna subsystem design, a proposed receiver design, preliminary outlines of the experiment controls and an analysis of on-board and ground data processing schemes. Author

N76-23462*# Radio Sciences Co., Lowell, Mass.
CHARACTERISTICS OF MAGNETOSPHERIC RADIO NOISE SPECTRA Final Report, Dec. 1974 - Dec. 1975
John R. Herman 2 Apr. 1976 85 p refs
(Contract NAS5-20807)
(NASA-CR-144751; RSCR-76-1) Avail: NTIS HC $5.00 CSCL 20N

Magnetospheric radio noise spectra (30 kHz to 10 MHz) taken by IMP-6 and RAE-2 exhibit time-varying characteristics which are related to spacecraft position and magnetospheric processes. In the mid-frequency range (100-1,000 kHz) intense noise peaks rise by a factor of 100 or more above background; 80% of the peak frequencies are within the band 125 kHz to 600 kHz, and the peak occurs most often (18% of the time) at 280 kHz. This intense mid-frequency noise has been detected at radial distances from 1.3 Re to 60 Re on all sides of the Earth during magnetically quiet as well as disturbed periods. Maximum occurrence of the mid-frequency noise is in the evening to midnight hours where splash-type energetic particle precipitation takes place. "Magnetospheric lightning" can be invoked to explain the spectral shape of the observed spectra. Author

N76-23463# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF ATCRBS ELECTRONIC SCAN ANTENNA (FIELD ENVIRONMENT TESTS) Interim Report, Jan. 1973 - Jun. 1975
Anthony D. Bradley Jan. 1976 100 p refs
(AD-A021771/1; FAA-NA-75-42; FAA-RD-75-219) Avail: NTIS HC $5.50 CSCL 17/9

The ability of the electronic scan antenna (ESA) to overcome siting problems in a representative field environment as compared to the existing air traffic radar beacon system (ATCRBS) in-service antennas is discussed. It was concluded that the ATCRBS ESA improved the vertical lobing pattern over flat terrain and provided a matched directional and omnidirectional pattern in comparison with the ATCRBS in-service antennas. However, local environment conditions along one particular radial at the terminal radar/beacon test facility caused severe low-elevation angle interference (vertical lobing), and diffraction of the ATCRBS ESA directional and omnidirectional beam patterns were noted from a vertical obstruction. Beam hopover, combined with improved side lobe suppression system operation, effectively eliminated reflections from a nearby large aircraft hanger building. Author

N76-23464# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SUMMARY OF DABS ANTENNA STUDIES
J. C. Sureau 3 Feb. 1976 50 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A021321/5; ATC-53; FAA-RD-75-112) Avail: NTIS HC $4.50 CSCL 17/9

Studies completed on the DABS antenna concept were documented. A DABS antenna is characterized by the simultaneous availability of three beams: (1) a sum beam through which all data is transferred, (2) a monopulse difference beam used for target direction finding, and (3) a control beam, whose function is to guarantee that all transactions occur in the main beam. It was concluded that: (1) whereas the desirable azimuth characteristics arise from the basic required functions and from the necessity to minimize the effects of the RF (target) environment, the desirable elevation features are such as to reduce the effects of the physical environment, and (2) implementation options are very sensitive to the type (if any) of primary radar with which it is to be collocated. Author

N76-23465# Commission of the European Communities, Ispra (Italy). Joint Research Centre.
LAM-16, A 16 CHANNEL LOW-LEVEL AMPLIFIER AND MULTIPLEXER
M. J. Mol and R. Kleih 1975 51 p refs
(EUR-5378e) Avail: ERDA Depository Libraries HC $5.00

A self-contained low-level amplifier and multiplexer is described, which is based on low-cost special purpose plug-in amplifiers. These amplifiers were designed to operate on low-level signals from sensors with low source resistances. The multiplexer switching rate of up to 100 kHz allows the multiplexing of a large number of signals on a single wide band recording or transmission channel. Author (ERA)

N76-23466# Naval Research Lab., Washington, D.C.
INVESTIGATION OF THE STIMULATION OF ULF WAVES
John W. Willis and John R. Davis 13 Nov. 1975 40 p refs
(NRL Proj. R07-23; RF21222402)
(AD-A018245; NRL-7925) Avail: NTIS CSCL 17/2

Two methods of artificially stimulating ultra-low-frequency (ULF) waves in the ionosphere have been investigated experimentally. Radio-frequency heating of the ionospheric-dynamo-current region has been attempted using a high-frequency transmitter and has been found to be ineffective. Pulse modulation of the U.S. Navy VLF transmitter at Cutler, Maine, has been explored as a means of stimulating geomagnetic micropulsations. In a month-long experiment the transmitter was square-wave modulated at frequencies of 0.2, 1, and 5 Hz, with a network of sensitive magnetometers employed as micropulsation detectors. Though the experimental results are not statistically conclusive, micropulsations occurred on several occasions at harmonics of the transmitter modulation frequency. It is likely that ULF waves may be stimulated by this means under magnetically quiet conditions immediately following geomagnetically active days. It is concluded that practical means of emitting ULF waves for global communications are prohibitively expensive by comparison to other alternatives in the extremely-low-frequency or higher bands. GRA

N76-23467# Physical Dynamics, Inc., Berkeley, Calif.
RADAR SCATTERING FROM A RANDOM OCEAN SURFACE PERTURBED BY A SURFACE CURRENT Interim Report
John Jarem and Bruce J. West Aug. 1975 73 p refs
(Contract F30602-72-C-0494; ARPA Order 1649)
(AD-A019523; PD-74-057; RADC-TR-75-207) Avail: NTIS CSCL 17/9

The scattering of radar energy from a rough ocean surface is considered using the approximations of physical optics and perturbation theory. The ocean surface is taken to be generated by a random process with zero mean value and a homogeneous covariance function represented by a wavenumber energy spectrum. For slightly rough seas the coherent and incoherent backscatter cross-sections are obtained for a general ocean spectrum. For very rough seas, the physical optics cross-sections were calculated for a Gaussian ocean spectrum neglecting shadowing. Scattering from ripples where the ocean surface radius of curvature is no longer large compared to radar wavelength was treated by perturbation theory using the magnetic dyadic Green's function for a half plane. GRA

N76-23468# Parke Mathematical Labs., Inc., Carlisle, Mass.
A COMPUTER SIMULATION SCHEME FOR AN AIRCRAFT MOVING TARGET INDICATION SYSTEM, PART 2 Final Report, Jan. 1973 - Jul. 1975
Theodore B. Barrett Oct. 1975 70 p refs
(Contract F19628-73-C-125; AF Proj. 5635)
(AD-A018663; AFCRL-TR-75-0539-Pt-2; Rept-0125-F) Avail: NTIS CSCL 17/9

This is part 2 of a 2 part report. In this part digital filter design fundamentals are reviewed and subroutine algorithms described for implementing digital filters for use in AMTI simulation schemes. The overall simulation scheme is summarized and rules presented for fitting computer subroutines into this scheme. Author (GRA)

N76-23469# General Atronics Corp., Philadelphia, Pa.
ADAPTIVE ARRAY CONTROL Final Report, 1 Nov. 1973 - 1 Feb. 1975
Lawrence R. Burgess, Andrew E. Zeger, and James R. Binkley (Adaptronics, Inc., McLean, Va.) Oct. 1975 178 p refs
(Contract F33615-74-C-1021; AF Proj. 2002)
(AD-A018744; GAC-2622-2827-19; AFAL-TR-75-59) Avail: NTIS CSCL 17/9

Radar targets such as slow, low flying aircraft and moving ground vehicles may be detected by employing an adaptively controlled antenna array with an AMTI radar set, conformally mounted in a high performance jet aircraft. Clutter cancellation is achieved through moving the active subaperture of the phased array to the rear of the aircraft with the transmission and reception of each pulse. The adaptive control unit which forms these subapertures employs a Guided Accelerated Random Search algorithm to maximize the clutter cancellation rate of a coherent two-pulse canceller. The test results demonstrated that the adaptive array control circuitry can achieve at +8.5 db output target-to-clutter power ratio for moving targets as much as 34 db below the input clutter power. It took approximately one hundred iterations of the control algorithm to reach the minimum normalized cancelled clutter power level and less than fifty iterations to achieve 30 db of clutter cancellations. Author

N76-23470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WARNING RADAR ANTENNA
Lien-yin Ko-li-Lai 16 Dec. 1975 7 p Transl. into ENGLISH from Hang K'ung Chih Shih (People's Republic of China), v. 4, 1 Apr. 1974 p 32-34
(AD-A019171; FTD-ID(RS)I-2372-75) Avail: NTIS CSCL 17/9

The article discusses a radar antenna which is a light and convenient type of warning radar antenna. It is called an in phase 'wave duct' antenna array and is composed of several identical 'wave duct' type antenna. GRA

N76-23287 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
RADAR DETECTION AND TRACKING IN GROUND CLUTTER
R. D. Mitchell, M. R. Paglee, G. M. Sparks, and G. H. Stevens *In* AGARD Range Instrumentation, Weapons Systems Testing and related Techniques Feb. 1976 20 p refs (For availability see N76-23283 14-09)

N76-23309* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ATMOSPHERIC WATER VAPOR CALIBRATIONS: RADIOMETER TECHNIQUE
F. B. Winn, S. C. Wu, G. M. Resch, C. C. Chao, O. H. VonRoos, and H. S. Lau (Stanford Univ.) *In its* The Deep Space Network 15 Apr. 1976 p 38-49 refs (For availability see N76-23304 14-12)
CSCL 20N

N76-23310* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S- X-BAND EXPERIMENT: DEVELOPMENT AND EVALUATION OF A SET OF GROUP DELAY STANDARDS
T. Y. Otoshi and R. W. Beatty *In its* The Deep Space Network 15 Apr. 1976 p 50-64 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23312* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF COMMAND DETECTOR IN-LOCK MONITORING
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1976 p 70-73 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23313* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT EQUIPMENT: RADIO FREQUENCY SECTION
G. Stevens *In its* The Deep Space Network 15 Apr. 1976 p 74-80 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23317* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL DEMODULATION WITH A NON-IDEAL QUANTIZER
J. W. Layland *In its* The Deep Space Network 15 Apr. 1976 p 100-105 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23329* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHASE-STABLE RECEIVER DEVELOPMENT
C. E. Johns *In its* The Deep Space Network 15 Apr. 1976 p 241-246 refs (For availability see N76-23304 14-12)
CSCL 17B

N76-23334* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE EFFECTS ON TRANSMISSION LINE PHASE AND GROUP DELAY
H. R. Buchanan and A. L. Price *In its* The Deep Space Network 15 Apr. 1976 p 296-300 refs (For availability see N76-23304 14-12)
CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-23471 British Library Lending Div., Boston Spa (England).
CURRENT-ZERO PHENOMENA IN HIGH VOLTAGE CIRCUIT-BREAKERS
R. Szabo-bakos Dec. 1975 32 p refs Transl. into ENGLISH from Elelctrotechnika (Budapest), v. 67, nos. 4-6, 1974 p 159-171
(BLL-RTS-9869) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 40 BLL photocopy coupons

Current-zero phenomena is dealt with to the extent necessary

to become acquainted with measurable voltage changes, and the reasons for these, at the circuit-breaker terminals. Author

N76-23472 British Library Lending Div., Boston Spa (England).
THE INSULATING PROPERTY OF UNEVENLY POLLUTED HIGH-VOLTAGE INSULATORS WITH POWER-FREQUENCY ALTERNATING VOLTAGE
W. Heise and H. K. Kothe [1966] 17 p refs Transl. into ENGLISH from Elektrotech. Z. A(West Germany). v. 87, no. 22, 28 Oct. 1966 p 777-782 In ENGLISH and GERMAN
(BLL-AR-Trans-317-(9022.823)) Avail: British Library Lending Div. Boston Spa, Engl.: 2 BLL photocopy coupons

Surface pollution formed on insulators in polluted areas under service conditions are generally unevenly distributed. Nevertheless, in investigations of the insulating property of high voltage insulators with artificial pollution layers, attempts are made to make the pollution distribution as even as possible with a view to the reproducibility of test results in test methods. Complete uniformity cannot however be achieved. Consequently the layer conductivity, which is calculated with the aid of the layer conductance measured between the fittings, is always a mean value. Author

N76-23473 British Library Lending Div., Boston Spa (England).
NEW ACTIVATOR SYSTEM FOR MANUFACTURING PRINTED CIRCUITS
H. J. Ehrich Jan. 1976 14 p refs Transl. into ENGLISH from Galvanotechnik (Saulgau/Wuertt.), no. 1, 1975 p 18-21
(BLL-RTS-9920) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

The development of a very easily adsorbable tin oxide hydrate layer in which palladium is installed, reduced and held fast is described by this shortened trade term. Whereas hitherto the processes were allowed to take place separately, today they are included in the 'Hot Pot System'. The palladium can be present in the reaction mixture either already reduced in the finely dispersed state or in the form of a made up complex compound. In each case, after subsequent rinsing in water, the metal has become embedded in the tin oxide hydrate, which has to be dissolved complexly in the subsequent immersion process and removed. Author

N76-23474 West Virginia Univ., Morgantown.
A NEW METHOD FOR CALCULATING THE EFFECT OF FAULTS IN LOGIC CIRCUITS: THE BIT STRING METHOD Ph.D. Thesis
Robert Edwin Michael 1975 107 p
Avail: Univ. Microfilms Order No. 76-11774

For the efficient simulation of classical faults in logic circuits, the two basic methods used are the parallel fault calculation method and the deductive fault calculation method. The 'bit string' method is a hybrid of the parallel and deductive methods. Instead of a Tval (true logic value) and fault word (for parallel) or fault list (for deductive), each gate has a Tval, a bit string of length just long enough to hold all the bits that are different from the Tval, and the starting displacement of the string (fault number of the first bit in the string). Algorithms for the efficient calculation of the output bit string of a gate given its input bit strings were developed. A bit string simulator was compared to similar implementations of a deductive simulator and a 2048 fault parallel simulator. The comparison was made by simulating representative circuits such as shift registers, sequences, counters, memory units, arithmetic units, controllers, and a processor. The results indicate that the bit string simulator is faster than the 2048 fault parallel simulator, sometimes by a large amount. Dissert. Abstr.

N76-23475 Saskatchewan Univ., Saskatoon.
ANALYSES OF SQUIRREL CAGE WINDINGS WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF A HIGHLY STABLE RELUCTANCE MACHINE Ph.D. Thesis
Sirag El-Dean El-Sayed Abo-Shady 1975 272 p
Avail: Univ. Microfilms Order No. 76-10547

A survey of various types of reluctance machines is presented. It is shown that the performance of a conventional reluctance machine can be enhanced to a great extent by changing the distribution of the rotor bars. A simple and realistic method of analysis is developed for investigating the effects of the distribution of the rotor bars on the asynchronous, the dynamic stability and the transient behavior of conventional reluctance machines. In light of the asynchronous, the transient and the stability performance of a specific machine, two suitable arrangements are recommended for the rotor bars. These arrangements are characterized by the outstanding features of minimum amplitude of the pulsating torque, smooth torque-slip characteristics, stable operation at all frequencies, moments of inertia and operating loads and better capability of pulling-into-synchronism. Dissert. Abstr.

N76-23476 British Library Lending Div., Boston Spa (England).
CURRENT DENSITY STABILIZATION IN GALVANIC BATHS
W. Baranowski Feb. 1976 11 p Transl. into ENGLISH from Galvanotechnik (West Germany), no. 1, 1975 p 13-17
(BLL-RTS-9919) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

The potentialities of bath characteristic control and the requirements which this imposes on the electroplating shop are considered. The limits of the method along with the difficulties are shown. Practical hints on how to overcome them are given. L.S.

N76-23477 British Library Lending Div., Boston Spa (England).
ADDITIVE PROCESS FOR THE PRODUCTION OF PRINTED CIRCUIT BOARDS
K. Erdei Feb. 1976 10 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 66, no. 4, 1975 p 305-308
(BLL-RTS-10016) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

Introduction of the additive process offers new prospects for the production of printed circuit boards. The process described is best designated semi-additive, as about 5 micrometers of copper is first applied to the entire surface of the board and the circuit is then formed by etching of the superfluous copper film. In the purely additive process etching is not used: the circuit is produced by optical sensitization even before the chemical copper is deposited. Author.

N76-23478 British Library Lending Div., Boston Spa (England).
MAIN SOURCES OF NOISE IN DIRECT-CURRENT ELECTRIC MOTORS
I. S. Iliev et al Apr. 1976 11 p refs Transl. into ENGLISH from Elektro Prom. Priborostr. (USSR), no. 6, 1974 p 179-181
(BLL-RTS-10068) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL photocopy coupons

In order to take effective measures to reduce the level of noise created in d.c. motors it is necessary first of all to determine the sources, frequencies and level of the noise, and also the dependence of the frequencies and level of the noise on the parameters of the machine. Direct-current electric motors emit noise of magnetic origin, aerodynamic origin, mechanical origin and noise from the brushes. Each of these noise sources is briefly discussed. Author

N76-23479*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BANNING STANDARD CELL ENGINEERING NOTEBOOK
Mar. 1976 298 p
(NASA-TM-X-73299) Avail: NTIS HC $9.25 CSCL 09C

A family of standardized thick-oxide P-MOS building blocks (standard cells) is described. The information is presented in a form useful for systems designs, logic design, and the preparation of inputs to both sets of Design Automation programs for array design and analysis. A data sheet is provided for each cell and gives the cell name, the cell number, its logic symbol, Boolean equation, truth table, circuit schematic circuit composite, input-output capacitances, and revision date. The circuit type file, also given for each cell, together with the logic drawing contained on the data sheet provides all the information required to prepare input data files for the Design Automation Systems. A detailed description of the electrical design procedure is included. Author

N76-23480# Israeli Program for Scientific Translations Ltd., Jerusalem.

ELECTRICAL FISHING: THEORY AND PRACTICE
V. G. Sternin, I. V. Nikonorov, and Yu. K. Bumeister 1976 324 p refs Transl. into ENGLISH of the book "Elektrolov ryby. Osnovy teorii i praktika" Moscow, Pishchevaya promyshlennost, 1972 324 p Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50005; ISBN-0-7065-1536-6) Avail: NTIS HC $9.75

The direct effect of electric fields in the water on fish and aquatic animals was examined. Topics discussed include: electrical conductivity, and electric fields in natural waters; electrochemical phenomena on the surface of electrodes; electric field of point, and line current sources; electrical conductivity between electrodes; and electrochemical calculations for alternating and pulsating currents. Fundamental aspects concerning the biological prerequisites and technical means of electrical fishing are presented. F.O.S.

N76-23481*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF S-BAND ANTENNA INTERFACE DESIGN, VOLUME 1 Final Report
E. A. Kuhlman 30 Apr. 1976 93 p refs
(Contract NAS9-14722)
(NASA-CR-147716; MDC-E1478) Avail: NTIS HC $5.00 CSCL 09C

The construction of an analytical thermal model of an S-band antenna in a typical Space Shuttle Orbiter installation is discussed. The selection and modeling of orbital and entry thermal environment inputs for the thermal analyses are discussed. The results of analyses for a variety of orbital thermal environments and entry initial conditions are given. Design and fabrication details of a thermal test fixture which physically approximates the Orbiter installation are discussed. The design and fabrication of two electrical test fixtures which electrically simulate the Orbiter surface shape and thermal protection system are discussed. Author

N76-23482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNIFYING IMAGE INTENSIFIER Patent Application
James Vine, inventor (to NASA) (Westinghouse Electric Corp., Pittsburgh) Filed 28 Apr. 1976 12 p
(Contract NAS5-20511)
(NASA-Case-GSC-12010-1; US-Patent-Appl-SN-680958) Avail: NTIS HC $3.50 CSCL 09C

An improvement in a magnetically focused image intensifier increases the usable range of magnification without degradation of image quality while keeping to a minimum the power requirements of the focusing coils. The improvement comprises an arrangement of focusing coils which reverses the direction of the axial magnetic field distribution between the planes of the photocathode and the phosphor screen. NASA

N76-23483*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHARGE INJECTION METHOD AND APPARATUS OF PRODUCING LARGE AREA ELECTRETS Patent Application
Edward L. Shriver (NAS-NRC) and Orville Weaver, inventors (to NASA) (NAS-NRC) Filed 10 May 1976 15 p Sponsored by NASA
(NASA-Case-MFS-23186-1; US-Patent-Appl-SN-684810) Avail: NTIS HC $3.50 CSCL 09C

Apparatus and a method are described for producing hetero-charged or homo-charged electrets using a corona discharge electrode. A dielectric material is passed over, or through, a heated, electrically conductive plate while a corona discharge is induced a slight distance above the dielectric, and due to the slight conductivity of the heated dielectric, a portion of the electrical plasma thus created is injected into the heated dielectric a small distance below its surface. The moving dielectric is then cooled forming a homo-charged electret. Alternatively, the electret can be produced by introducing a spray or mist of liquid dielectric into the corona region causing the liquid droplets in the mist or spray to become electrically charged and settle on an unheated stationary sheet, or a roll of continuously moving dielectric passing through the region of the corona discharge. NASA

N76-23484# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION REQUIREMENTS FOR RUNWAY VISUAL RANGE SYSTEMS Final Report, 1 Feb. - 15 Jun. 1975
Marvin D. Drake, Andrew W. Revay, Jr., and Richard M. Cosel Dec. 1975 49 p refs
(Contract DOT-FA72WAI-356)
(AD-A022395/8; FAA-RD-75-181) Avail: NTIS HC $4.00 CSCL 09/3

The degree of susceptibility of Federal Aviation Administration solid state electronic systems to induced electromagnetic pulse effects due to lightning was studied, and protective devices adequate for these low voltage systems are proposed. The investigation of the protection required for Runway Visual Range equipment is covered. Identification of the susceptible components and specific recommendations for installation of protective devices are discussed. Author

N76-23485# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
GROUNDING, BONDING, AND SHIELDING PRACTICES AND PROCEDURES FOR ELECTRONIC EQUIPMENTS AND FACILITIES. VOLUME 1: FUNDAMENTAL CONSIDERATIONS Final Report, Mar. 1972 - Dec. 1975
H. W. Denny, L. D. Holland, S. L. Robinette, and J. A. Woody Dec. 1975 428 p refs 3 Vol.
(Contract DOT-FA72WA-2850)
(AD-A022332/1; FAA-RD-75-215-Vol-1) Avail: NTIS HC $10.75 CSCL 09/3

A set of grounding, bonding, and shielding principles and practices for electronic equipments and facilities is presented. The topics of personnel protection, fault protection, lightning protection, interference reduction, EMP protection, signal grounding, electromagnetic shielding, and electrical bonding are covered. The subjects are considered in terms of their influence on the design of the earth electrode system, the selection of ground reference networks for equipments and structures, shielding requirements, facility and equipment bonding requirements, cable selection and installation, etc. Author

N76-23486# Atomic Weapons Research Establishment, Aldermaston (England).
MICROCIRCUIT THERMAL DESIGN TABLES. VOLUME 1A: SUBSTRATE ASPECT RATIO 2:1 CONDUCTION COOLED AT ONE EDGE
D. J. Dean and P. G. Hambling Apr. 1975 131 p
(AWRE-O-9/75) Avail: ERDA Depository Libraries HC $9.75

In thermal design studies the calculations are repetitious when various heat patterns are studied. These tables have been calculated to allow values of excess temperature on substrates to be determined rapidly with little effort. The data contained in these tables can be readily compiled in a computer for direct calculation or for use in interactive graphical display. Author (ERA)

N76-23487# Atomic Weapons Research Establishment, Aldermaston (England).
MICROCIRCUIT THERMAL DESIGN TABLES. VOLUME 2B: SUBSTRATE DIMENSIONS 3 INCHES BY 1 INCH CONDUCTION COOLED AT ONE EDGE AND FORCED CONVECTION FROM BOTH FACES
D. J. Dean and P. G. Hambling Jun. 1975 186 p refs
(AWRE-O-12/75) Avail: ERDA Depository Libraries HC $12.50

In thermal design studies the calculations are repetitious when various cooling and heat patterns are studied. The tables presented have been calculated to allow values of excess temperature on substrates to be determined rapidly with little effort. The data contained in these tables can be readily compiled in a computer for direct calculation or for use in interactive graphical display. ERA

N76-23488# California Univ., Livermore. Lawrence Livermore Lab.
PARALLELISM IN AUTOMATIC TESTING
M. N. Matelan 12 Aug. 1975 7 p refs Presented at the Sagamore Computer Conf., Raquette, N. Y., 20-22 Aug. 1975 Sponsored by ERDA

(UCRL-77132; Conf-750834-1) Avail: NTIS HC $4.00

The architecture of the DELTA (Destributed Electronic Test Analysis) System, and its impact on test equipment control and software, is discussed. The system is based on distributing the major functions common to all testing among a group of function-specific microprocessors. These microprocessors, driven by test-mode selectable control programs, are linked in ways which allow run-time configuration of the tester on a by-test basis. The use of microprocessors to implement a high speed interpretive version of a high level test language is described. The use of a firmware generator to develop function-defining control code is outlined. Author (ERA)

N76-23489# Iowa State Univ. of Science and Technology, Ames.

STABLE CONSTANT CURRENT POWER SUPPLY WITH REPRODUCIBLE CURRENT CONTROL

W. D. Jung Jul. 1975 25 p

(Contract W-7405-eng-82)

(IS-3631) Avail: NTIS HC $4.00

A highly stable constant current power supply to provide reproducible current control has been developed. Precise reproducibility is highly desirable for measurements such as thermal conductivity and electrical resistivity where it is necessary to provide known currents of varying magnitude and either polarity. A power supply is examined which was built with two independent outputs and with current ranges of 0.1A to 2A and 0.3mA to 63mA. Author (ERA)

N76-23490# Los Alamos Scientific Lab., N.Mex.

TEN kA LOW RESISTANCE SUPERCONDUCTING SWITCH

J. D. G. Lindsay and D. J. Blevins 1975 5 p refs Presented at the 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975

(Contract W-7405-eng-36)

(LA-UR-75-2115; Conf-751125-57) Avail: NTIS HC $4.50

A low resistance superconducting switch for use in initiating transfer of energy from an inductive energy storage coil was constructed and tested at Los Alamos Scientific Laboratory. The switch will be used in series with a mechanical circuit breaker to reduce the current through the breaker prior to its opening. Both mechanical breaker and switch are immersed in liquid helium. Opening the switch before the mechanical breaker will reduce arcing and burning of the mechanical breaker contacts and reduce the rate at which the heat generated during the switching operation is deposited into the helium bath. A detailed description of the switch design and construction is given as well as the initial design parameters and test results. A circuit diagram of the switching scheme and a discussion of the circuit is also given. Author (ERA)

N76-23491# Sandia Labs., Albuquerque, N.Mex.

FABRICATION OF 2-4 MUM MAGNETIC BUBBLE MEMORIES WITH ELECTRON BEAM NEGATIVE RESIST LITHOGRAPHY

J. N. Sweet, D. H. Schroeder, J. K. Maurin, and J. R. Adams 1975 10 p refs Presented at the 21st Ann. Conf. on Magnetism and Magnetic Mater., Philadelphia Sponsored by ERDA

(SAND-75-6092; Conf-751209-2) Avail: NTIS HC $4.50

Electron lithographic techniques with co-polymer (Co-P) negative resist and ion milling were used to fabricate small prototype 2 micron and 4 micron, single level bubble test circuits. The 4 micron circuits were used to evaluate two different generator and two different detector designs while the 2 micron circuits were used to study small bubble propagation characteristics. The minimum interelement spacing which could be routinely produced was about 0.8 micron which is just adequate for reliable 2 micron bubble propagation. Author (ERA)

N76-23492# Naval Postgraduate School, Monterey, Calif.

IMPLEMENTATION OF COMB FILTERS BY SAMPLED ANALOG TECHNIQUES M.S. Thesis

Bruce Richard Freund Jun. 1975 155 p refs

(AD-A018322) Avail: NTIS CSCL 09/4

The design of sampled analog filters using z-transform techniques developed in digital filter theory is studied. Both recursive and non-recursive algorithms are implemented and analyzed. Some deviations from theoretical frequency responses are noted. An analog Fourier transformer is constructed by cascading a recursive comb filter and a non-recursive bandpass filter. GRA

N76-23493# Sperry Rand Research Center, Sudbury, Mass.

INTEGRATED SURFACE ACOUSTIC WAVE CONVOLVER/AMPLIFIER Final Technical Report, 6 May 1974 - 6 Jun. 1975

L. P. Solie Nov. 1975 45 p refs

(Contract F30602-74-C-0270; AF Proj. 5573)

(AD-A018440; SCRC-CR-75-11; RADC-TR-75-191) Avail: NTIS CSCL 09/5

The work on this contract involves the development of a highly efficient surface wave convolver by means of bidirectional surface wave amplification of the counter-traveling surface waves to compensate for the attenuation they would otherwise incur. The surface wave propagates along a piezoelectric substrate (YZ LiNbO3) with a semiconducting film overlay (CdSe). The same interdigital electrodes which detect the convolution signal are used to apply the dc bias fields on the semiconducting film for the surface wave amplification. As a result, the surface wave convolution is considerably enhanced and the signal duration may be much longer than is possible by other techniques. The convolution efficiency of -10 dBm is 20 dB to 80 dB higher than is possible by other types of surface wave convolvers. Perhaps the most significant result of the work done under this contract was the discovery of a new mode of operation. This is a degenerate mode whose existence depends upon the bidirectional amplification of this device. It should be noted that this degenerate mode is detected by an interdigital center structure and it is even more efficient than the nondegenerate mode. The interdigital electrodes may be skewed relative to the input transducers so reflections from the electrodes no longer limit the performance of the device in any way. GRA

N76-23494# Illinois Univ., Urbana. Coordinated Science Lab.

ANALYSIS OF SLOT LINE TYPE WAVEGUIDES M.S. Thesis

Nikola Samardzija Nov. 1975 54 p refs

(Contract DAAB07-72-C-0259)

(AD-A018452; R-697; UILU-ENG-75-2232) Avail: NTIS CSCL 09/1

The idea of having electromagnetic fields propagating along the slot in a metal sheet is not a new one. It has been used for radiating antenna elements, in which radiation was of primary interest. Also dielectric-covered resonant slots have been analyzed by Bailey in 1967. The basic difference between previous slot elements and the slot line is that in the latter we are interested in minimizing radiation in order to achieve superior transmission characteristics. GRA

N76-23495# Beta Industries, Inc., Dayton, Ohio.

RESEARCH AND DEVELOPMENT OF NON-ACTIVE SURFACE NEA EMITTER Interim Report, 1 Dec. 1974 - 31 May 1975

John L. Mize Oct. 1975 105 p refs

(Contract DAAB07-75-C-1295)

(AD-A018462; BII-235-1; ECOM-75-1295-1) Avail: NTIS CSCL 09/1

Studies and research have been conducted on the Variable Affinity Barrier (VAB), tin oxide cold cathodes. These studies were directed toward elucidating the underlying mechanisms responsible for the emission of electrons from these structures, and to establish optimum fabrication and activation techniques. Author (GRA)

N76-23320* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

X-BAND REJECT FILTER

R. Lay *In its* The Deep Space Network 15 Apr. 1976 p 118-122 refs (For availability see N76-23304 14-12)

CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-23496 British Library Lending Div., Boston Spa (England).
CALCULATION ON FINNED TUBE COOLER CONDENSERS
Tokuro Mizushima, Satoru Iuchi, Toshio Shima, Ikuo Ito, and Takeshi Hamaura Jan. 1976 19 p refs Transl. into ENGLISH from Kagaku Kogaku (Japan), v. 34, no. 3, 1970 p 60-66
(BLL-RTS-9518) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

A method for thermal fin efficiency calculation is examined which separates the coefficient for heat conduction accompanied with condensation from the heat transfer coefficient. The assumptions used in the method are verified by cooling mixed gases and using a finned tube as a cooler-condenser. Author

N76-23497 British Library Lending Div., Boston Spa (England).
CONSISTENCY AND HEAVY MEDIA PREPARATION
Winfried Berghoefer [1975] 48 p refs Transl. into ENGLISH from Bergbauwissenschaft (West Germany), v. 6, no. 20, 1959 p 493-504, 533-541
(BLL-M-23968-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The flow behavior of heavy media under various conditions was studied. Investigations were made of the effect of the temperature, the various particle sizes of the weighting agent, and the flow behavior when boundary-active and stabilizing agents are added. From these it was established that, for grading fine-grained ores, apart from the consistency, the limiting shear stress is significant. Practical hints were derived from the conclusions obtained. Author

N76-23498 British Library Lending Div., Boston Spa (England).
THE DISPERSION OF GASES IN LIQUIDS BY STIRRERS
Helmut Karwat [1975] 21 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), v. 31, no. 9, Sep. 1959 p 588-598
(BLL-M-23965-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The relationship between the power and effect of stirring in the gasification of liquids was investigated, using several types of stirrers. It was found that in gasification the design of the stirrer has no appreciable effect on the result of stirring. The experiments were carried out batchwise with sodium sulphite solutions and continuously with carbonate/bicarbonate solutions. Numerous efficiency measurements established that the most favorable power expenditure in gasification of liquids with stirrers is approximately 1 to 2 h.p./cu m. Author

N76-23499 British Library Lending Div., Boston Spa (England).
STUDY OF AGITATION BY MECHANICAL STIRRERS IN GAS-LIQUID SYSTEMS
A. G. Kasatkin, V. V. Kafarov, and M. N. Panfilov [1975] 32 p refs Transl. into ENGLISH from Tr. Mosk. Ordena Lenina Khimiko-Teknol. Inst. Imeni DI Mendeleeva (USSR), v. 24, 1957 p 413-427 In ENGLISH and RUSSIAN
(BLL-M-23950-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Relationships are formulated from which the energy consumption and the characteristic relationships between the hydrodynamic and diffusion phenomena in stirred gas-liquid systems can be evaluated. The basis of these relationships is used to determine conditions for modelling the hydrodynamic and diffusion phenomena and to find methods of quantitatively comparing the efficiencies of stirrers. Author

N76-23500 British Library Lending Div., Boston Spa (England).
SIMULATANEOUS HEAT AND MASS TRANSFER ON EXTENDED SURFACES
S. Iuchi, T. Oshima, S. Kagawa, N. Yamamoto, and Kagaku Kagaku Dec. 1975 15 p refs Transl. into ENGLISH from Kagaku Kogaku (Japan), v. 32, no. 2, 1968 p 51-56 Presented at Chem. Eng. Soc. Meeting, Osaka, Japan, Jul. 1966
(BLL-RTS-9516) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

When a mixture of condensing vapor and noncondensing gas is cooled and condensed by the use of a surface condenser, the heat transfer coefficient is known to become smaller as the humidity of the vapor decreases. For example, in the case of a water vapor-air system, when the humidity is about 1 [kg/kg dry air], the overall coefficient of heat transfer has a value of several hundred [kcal/sqm .hr. C], but a lower humidity results in a large decrease in the overall coefficient of heat transfer. Therefore, in the construction of a cooler condenser for low humidity gas mixtures, the use of a finned tube as a heat transfer structure is advantageous. The finned tube in a refrigerator can be taken as an example of a low humidity cooler condenser. Author

N76-23501 British Library Lending Div., Boston Spa (England).
RESEARCH INTO THE VELOCITIES IN PLANE INTERRUPTED FLOWS, REPORT 1
S. I. Slavin, A. I. Vashchenko, and M. I. Toptygin [1975] 10 p refs Transl. into ENGLISH from Izv. Vuz Chern. Met. (Moscow), no. 7, 1975 p 171-174
(BLL-M-25260-(5828.4F); Rept-1) Avail: British Library Lending Div., Boston Spa, Engl.

The effects of design parameters and flow conditions on the structures of plane interrupted flows were investigated. Relationships were obtained for distribution of velocities along the axis of a plane interrupted flow and in a transverse cross section. Author

N76-23502 British Library Lending Div., Boston Spa (England).
CERTAIN INSTANCES OF CHANGE IN BOUNDARY CONDITIONS
I. V. Kostarev and A. Makarov [1975] 10 p refs Transl. into ENGLISH from Izv. Vyssm. Ucheb. Zaved., Chern. Met. (USSR), no. 7, 1975 p 83-85
(BLL-M-25257-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

An examination was made of the problem of finding the metal flow parting line during the pressing of a long strip with longitudinal strengthening ribs, one of which was of constant length and the other of variable width. As an example of the solution to the problem, it is demonstrated that a method employing certain conclusions from the general theory of the flow of a fine plastic layer over rigid surfaces can also be used in the case of variable specific boundary pressures. A version of the solution for constant boundary specific pressures constitutes a special case of the solution suggested. Author

N76-23503 British Library Lending Div., Boston Spa (England).
COMPARISON OF THE POTENTIAL AND REFINED SOLUTIONS TO THE PROBLEM OF PLASTIC FLOW
G. Ya. Gun and V. I. Kostyunin [1975] 12 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (Moscow), no. 7, 1975 p 79-82
(BLL-M-25256-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A comparison is made of two solutions to the plane problem of plastic flow, viz. a solution formulated from the potential speeds field and the same solution made more accurate by introducing a stream correction function. The potential solution, though correctly describing the overall nature of the flow, can result in serious errors when analyzing concrete plastic flow parameters. Author

N76-23504 Lehigh Univ., Bethlehem, Pa.
FLUID FLOW IN ANNULAR AND RECTANGULAR PASSAGES WITH MASS TRANSFER AT THE WALLS Ph.D. Thesis
Bal K. Gupta 1976 139 p
Avail: Univ. Microfilms Order No. 76-10-368

An experimental and analytical study is presented of two dimensional channel and three dimensional axially symmetric annular flows with mass transfer at the porous walls. Steady, incompressible laminar flows are examined for the case of symmetric and asymmetric mass transfer of the bounding surfaces

of the channels and the annular passages. In all cases the channels and annular flow passages are considered to be relatively slender for the theoretical analysis and experimental verifications. The mathematical models are developed for generalized mass transfer on the surfaces of channels and annular flows. New techniques are developed to solve two point boundary value ordinary differential equations (similarity equations) and to solve the initial and two point boundary value partial differential equations (entry region equations). The similarity equations were reduced to equivalent initial value problems and were then solved by an iteration technique. Dissert. Abstr.

N76-23505 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THERMOMECHANICAL ABLATION Ph.D. Thesis
George Y. Jumper, Jr. 1975 189 p
Avail: Univ. Microfilms Order No. 76-10090

In order to investigate the heat and mass transfer aspects of thermomechanical ablation, ablation experiments were performed with models made of pure carbon dioxide (CO2) and a glass bead-CO2 composite. The experiments were performed in a low subsonic, low turbulence jet at ambient pressure and near 0 C temperature. The model geometry was a hemispherical forebody-cylindrical afterbody with a diameter of 25 mm. The stagnation point mass transfer of the pure CO2 models was 6.2% less than predicted by equilibrium theory. The distribution around the hemisphere generally agreed with the predicted laminar heat transfer result of monotonically decreasing heat transfer with distance from the stagnation point. The internal temperature response was approximately 5% higher than the theoretically predicted wall temperature. These results could be correlated by the inclusion of a nonequilibrium sublimation model into the theoretical prediction equations. Dissert. Abstr.

N76-23506 Saskatchewan Univ., Saskatoon.
A STUDY AND ANALYSIS OF A THREE-PHASE PULSATING FLOW HYDRAULIC SYSTEM Ph.D. Thesis
Yehia Mohamed El-Husseiny El-Ibiary 1975 193 p
Avail: Univ. Microfilms Order No. 76-11471

The purpose of this project was to design and build a completely new three-phase pulsating flow system. In carrying out the design, an attempt would be made to bypass the sources of the problems that were encountered in the earlier configurations. This would include the design and construction of a flow generator, transformers, rectifier unit, compensating unit and accumulators. The components would then be tested individually, and then within a complete system. Finally, in building the complete system, if there was a need for a mathematical description for some of the components, mathematical models would be derived for these components. Improvements to the system would then be suggested. Dissert. Abstr.

N76-23507 Pennsylvania State Univ., University Park.
INVESTIGATION OF THE MAGNETOHYDRODYNAMIC DAMPING OF TURBULENT JET WAVE SOURCES, USING A SHALLOW WAVE SIMULATION FOR JET NOISE Ph.D. Thesis
William Henry Colwill 1975 173 p
Avail: Univ. Microfilms Order No. 76-10716

A shallow liquid surface wave analogy to turbulence induced sound was utilized to investigate the effect of a longitudinal magnetic field on the wave production from a conducting jet. Analytically, the surface wave equation was derived including the magnetic source term. This equation was compared with its acoustic counterpart to validate the analogy. Further theoretical work served to identify certain magnetic effects which might accompany the turbulence damping. The experimental investigation utilized a 24 square foot mercury ripple tank. The waves were produced by the turbulence in a mercury jet exhausting into the tank. Damping of the turbulence was effected by a solenoidal magnet producing a field on the order of 1,500 Gauss. Initial results were used to experimentally substantiate the surface wave analogy. Measurement of mean and turbulent velocity profiles proved that the jet development was similar to the theoretical plane free jet. Dissert. Abstr.

N76-23508 Oklahoma State Univ., Stillwater.
DIGITAL COMPUTER SIMULATION OF COMPLEX HYDRAULIC SYSTEMS USING MULTIPORT COMPONENT MODELS Ph.D. Thesis
Christopher Kropp Smith 1975 88 p
Avail: Univ. Microfilms Order No. 76-9776

Included in this study are: (1) the definition of a set of functional forms for algebraic and differential equations which may be used to model the dynamics of hydraulic systems, (2) numerical algorithms which may be used to solve these modeling equations, and (3) an introduction to the HYDSIM program, a generalized and block-oriented simulation program for hydraulic systems which utilizes the modeling forms and algorithms given in this study. The modeling equations are described as coupled sets of nonlinear algebraic and differential equations. An implicit method is given for solving the equations. This method allows the algebraic equations as well as the differential equations to be solved by a numerical integration algorithm without iterations at each solution point. Dissert. Abstr.

N76-23509 Northwestern Univ., Evanston, Ill.
VISCOUS AND TURBULENT FLOWS ACROSS STEPS Ph.D. Thesis
Dauda Olasupo Salimonu 1975 364 p
Avail: Univ. Microfilms Order No. 76-11923

The applicability of simple theory, experiments and numerical simulation methods to the prediction of viscous and turbulent flows across one of such steps as may be found in bearing geometrics is demonstrated. The dependence of the predicted pressure distribution on various flow properties is shown. In the approximate theoretical analysis, for viscous flow, the two-dimensional Reynolds equation is applied to the step geometry to calculate the pressure distribution while for turbulent flow, an approximate analysis similar to the momentum integral method of boundary layer theory. Details of experimental measurements made in a one-step 'bearing' geometry are presented and relevant data on pressure and fluid velocity profile (where possible) measurements are shown for both viscous and turbulent flow runs. The magnitude of the pressure variation across the step is shown to be inversely proportional to the flow Reynolds for purely viscous flow while for turbulent flow, the pressure distribution is independent of Reynolds number. Dissert. Abstr.

N76-23510 Wisconsin Univ., Madison.
HYDRODYNAMICS AND STRUCTURE OF FREE LIQUID SURFACES Ph.D. Thesis
Hilmi Oender Oezbelge 1975 166 p
Avail: Univ. Microfilms Order No. 75-18612

The reflectance Schlieren technique has been successfully adapted to the measurement of the shapes of free moving liquid surfaces over a wide range of flow conditions, The measurements are sufficiently detailed and accurate to describe the underlying fluid motion when an adequate hydrodynamic model is available. Furthermore this information could then be successfully used to predict interfacial transport rates of dissolved gases, for example, oxygenation. Measurements of surface shape were made on turbulent open channel flows and also on surface tension driven Benard cells. These measurements cover a range of 0.65 mm to .00015 mm vertical surface deflections induced by the fluid motion underneath. Dissert. Abstr.

N76-23511 Pennsylvania State Univ., University Park.
VISCOSITY PRESSURE CORRELATION OF LIQUIDS Ph.D. Thesis
Bernard Van Cheung So 1975 158 p
Avail: Univ. Microfilms Order No. 76-10791

An analysis of the viscosity-pressure measurement in the PRL high pressure viscometer shows that gas solubility in the fluid as a result of diffusion at the gas-liquid interface represents the principal experimental problem. Studies show that diffusion rate of the gas into the liquid varies over a significant range and appears to be related to the fluid class. Significant errors can be shown after only one hour soak time at pressures as low as 3,000 psig. The gas solubility results in too low a measured viscosity at a given pressure. Polyolefins which show a significant diffusion rate are among the hydrocarbons that show a poor predicted pressure-viscosity value. In order to reduce the error due to gas solubility the limiting slope of the viscosity-pressure curve at 0 psig should be used to predict the viscosities at high pressures. Dissert. Abstr.

N76-23512 Ohio State Univ., Columbus.
THE EFFECT OF OPENINGS ON THE INFLOW INTO CORRUGATED PLASTIC DRAINS Ph.D. Thesis
Nicolas Jose Bravo 1975 76 p
Avail: Univ. Microfilms Order No. 76-9942

The relative effectiveness of the openings in corrugated plastic drains, as influenced by the presence of soil within the corrugations and within the openings themselves was studied from the standpoint of water flow under saturated conditions in a homogeneous, isotropic soil. The procedure involved the use of electrical analog models which provided empirical estimates of the relative flow into drain openings as well as of the boundary conditions to be used in mathematical models of these drains. Each mathematical model consisted of Laplace's equation in three dimensions with the boundary conditions appropriate to the case under consideration. After agreement between the physical and mathematical models was established for simple configurations, the electrical analog was used to obtain further estimates of the inflow into drains under conditions for which an exact analytical solution was deemed to be difficult or unattainable.
Dissert. Abstr.

N76-23513 California Univ., Los Angeles.
A STUDY OF THE TRAPPING OF SUPERFLUID PERSISTENT CURRENTS IN SUPERLEAKS Ph.D. Thesis
Joseph Edward Heiserman 1975 152 p
Avail: Univ. Microfilms Order No. 76-11526

Persistent currents in superleaks in contact with bulk superfluid helium were investigated using Doppler shifts of the acoustic modes of an annular resonator partially packed with superleak, and with a simple gyroscopic technique. In an annulus in which the bottom fraction was packed with fine powder and the upper part was left unpacked, there were two hydrid acoustic modes consisting of a combination of the three bulk sounds of superfluid helium, first, second and fourth sound. The two modes were studied between the temperatures 1.2 K and the lambda temperature for annuli 20, 40, 60 and 80 percent filled with superleak. The velocities obtained were compared with the predictions of the two fluid hydrodynamic theory and good agreement was found. Some observed discrepancies are discussed in terms of depression of the superfluid fraction in the superleak due to size effects and dispersion of sound in a tube by wall attenuation.
Dissert. Abstr.

N76-23514 British Library Lending Div., Boston Spa (England).
DEVELOPMENT OF OPTIMUM CONTROL OF THE HEATING OF MASSIVE BODIES
V. M. Ryabkov [1975] 10 p refs Transl. into ENGLISH from Inv. VUZ Chern. Met. (Moscow), no. 6, 1975 p 167-171
(BLL-M-25242-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A solution is given to the problem for optimum control of heating massive bodies with general form boundary conditions. The necessary optimality conditions are given in the form of the maximum principle, and are expressed in terms of boundary condition parameters. The form obtained for the necessary optimality conditions made it possible to arrive at optimum control, for fuel consumption. The optimum control algorithm was modelled with digital and analog computers using a model of a recuperative soaking pit. The results of modelling and experimental industrial use of the algorithm of optimum control for heating ingots show it to be efficient and a sound economic proposition.
Author

N76-23515 British Library Lending Div., Boston Spa (England).
OSCILLOGRAPHICAL INVESTIGATIONS INTO GAS-DISCHARGES IN NITROGEN AND HYDROGEN AT HIGH PRESSURE. PART 3: OBSERVATIONS IN HYDROGEN
E. K. Muller Apr. 1976 14 p refs Transl. into ENGLISH from Z. Angew. Phys. (West Germany), no. 6, 1966 p 554-558
(BLL-RTS-10075) Avail: British Library Lending Div. Boston Spa, Engl.: £5.00; 21 BLL photocopy coupons

Oscillographic studies of high pressure discharges in hydrogen up to a pressure of p = 19,000 Torr (gap d = 0.5 cm) and p = 33,000 Torr (d = 0.2 cm) are described. The known generation mechanism with photo-emission at the cathode (Townsend mechanism) is observed at up to about p = 10,000 Torr (d = 0.5 cm) and p = 16,000 Torr (d = 0.2 cm). At higher pressure, however, the discharge at d = 0.5 cm starts by a slow (within sec) increase of local electron emission on the cathode surface (emission build-up). The breakdown events in the range of the deviation from Paschen's law (for d = 0.2 cm) show a very fast (within nsec) current increase (channel build-up).
Author

N76-23516 National Lending Library for Science and Technology, Boston Spa (England).
A CIRCULAR TURBULENT JET IN AN UNLIMITED TRANSVERSE FLOW
I. V. Belov 1975 11 p refs Transl. into ENGLISH from Izvest. Vuz (USSR), v. 8, 1975 p 130-134
(NLL-M-25268-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

An accurate solution is given of the differential-integral equation proposed by G. N. Abramovich for representing the axis of a circular turbulent jet in a transverse flow, and an equation is obtained for the running mass of the jet. It is proved that the recognized results of measuring those jets are effectively represented by the solution found using a single experimental constant, the numerical value of which depends on the ratio of the initial dynamic head of the jet to the dynamic head of the transverse flow. It is established that Yu. V. Ivanov's empirical equation for the axis of a jet corresponds to the approximate solution of the theoretical equation.
Author

N76-23517 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EFFECTS OF ISOTROPIC AND ANISOTROPIC BULK LINERS ON WAVE PROPAGATION IN DUCTS CARRYING FLOWS Ph.D. Thesis
John Sun 1975 111 p
Avail: Univ. Microfilms Order No. 76-11273

An analysis is presented of the transmission and attenuation of acoustic waves propagating inside both two-dimensional and cylindrical ducts. The ducts carry mean flow and are treated by isotropic as well as anisotropic liners. These liners are composed of porous isotropic (or anisotropic) bulk- and point-reacting materials followed by cellular honeycomb cavities. The effects of combined transverse temperature and velocity gradients on wave attenuation are also included. Analytical expressions are obtained for the impedance of the liner and the wave propagation in the liner is coupled with that in the duct media. Numerical schemes are employed to determine the influence on attenuation rates in terms of material physical properties, sound frequency, flow characteristics, temperature environments, spinning and nonspinning modes, and the geometrical parameters of the problem.
Dissert. Abstr.

N76-23518*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STEADY NORMAL SHOCK WAVE SOLUTION TABLES OF PARAHYDROGEN FOR TOTAL TEMPERATURES FROM 30 K TO 290 K AND FOR TOTAL PRESSURE FROM 1 ATM TO 10 ATM
Richard C. Haut, (Old Dominion Univ.) and Jerry B. Adcock Apr. 1976 100 p refs
(NASA-TM-X-73899) Avail: NTIS HC $5.00 CSCL 20D

The steady normal shock wave solutions of parahydrogen at various total pressures and total temperatures were numerically determined by iterating the upstream Mach number and by using a modified interval halving technique. The results obtained are compared with the ideal diatomic gas values and are presented in tabulated form.
Author

N76-23519# Israeli Program for Scientific Translations Ltd., Jerusalem.
THE SEISMICS OF HETEROGENEOUS AND TURBID MEDIA
A. V. Nikolaev 1975 144 p refs Transl. into ENGLISH of the book "Seismika neodnorodnykh i mutnykh sred" Moscow, Izd. Nauka, 1972 144 p Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50004; ISBN-0-7065-1535-8) Avail: NTIS HC $6.00

The following aspects of seismic phenomena in heterogeneous and turbid media were discussed: (1) the makeup of the medium and the nature of the wave field, (2) the interpretation of seismic-wave fluctuations, (3) seismic experiments, (4) model

studies of turbid media, (5) studies of the heterogeneity of the earth's crust based on data for southern Kazakhstan, (6) studies of the turbidity of the earth's crust and upper mantle based on marine data, and (7) studies of the earth's heterogeneity based on seismological data. Y.J.A.

N76-23520*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
APPLICATION OF THE RAMAN EFFECT TO GAS FLOW VISUALIZATION
Matthieu Merian Washington NASA May 1976 12 p refs Transl. into ENGLISH from Rech. Aerosp. (France), no. 2, Mar. - Apr. 1972 p 85-89
(Contract NASw-2789)
(NASA-TT-F-16999) Avail: NTIS HC $3.50 CSCL 20D

The possibility of applying the Raman effect to the measurement of densities at points within gas flows is demonstrated. The frequencies of the Raman spectral lines of a molecule are specific to the species analyzed, and their intensities are proportional to the gas density. The setup developed at ONERA for this measurement is described, and results obtained for a jet of Freon-12 are presented. Author

N76-23521*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VORTEX GENERATOR CONTROLLING THE DISPERSION OF EFFLUENTS IN A FLOWING LIQUID Patent Application
Robert C. Costen, inventor (to NASA) Filed 3 May 1976 10 p
(NASA-Case-LAR-12045-1; US-Patent-Appl-SN-682416) Avail: NTIS HC $3.50 CSCL 20D

A method is described for controlling the dispersion of effluents in a flowing liquid. A vortex generator for creating a distinct recirculating vortical flow is located in a flowing liquid and effluents are discharged into the vortical flow. The effluents are entrained in the vortical flow and by selectively positioning the vortex generator the dispersion of the entrained effluents can be controlled. NASA

N76-23522*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIR REMOVAL DEVICE Patent Application
Franklin W. Booth and Robert A. Bruce, inventors (to NASA) Filed 27 Feb. 1976 8 p
(NASA-Case-XLA-8914-2; US-Patent-Appl-SN-662181) Avail: NTIS HC $3.50 CSCL 20D

A device is described suitable for removing air from water under both zero and one g gravity conditions. It is comprised of a pair of spaced membranes, one being hydrophobic and the other being hydrophilic. The air-water mixture is introduced into the space between, and the selective action of the membranes removals of the air from the water. NASA

N76-23523# Atomic Weapons Research Establishment, Aldermaston (England).
PLOTEM 2: A FORTRAN PROGRAM THAT COMPUTES THE TEMPERATURE DISTRIBUTION ACROSS A THIN, RECTANGULAR MICROCIRCUIT WHICH IS COOLED BY CONDUCTION TO HEAT SINKING EDGES AND BY CONVECTION
P. G. Hambling Aug. 1975 27 p refs
(AWRE-O-30/75) Avail: ERDA Depository Libraries HC $4.50

A program in FORTRAN 4 currently used on IBM 370/168 to compute temperature distribution across a thin, rectangular conduction and convection cooled microcircuit is described. Flow charts (with a commentary), a user's manual and a worked example are given. Author (ERA)

N76-23524# California Univ., Livermore. Lawrence Livermore Lab.
VAPOR-DROPLET FLOW EQUATIONS
C. T. Crowe 18 Aug. 1975 31 p refs
(Contract W-7405-eng-48)
(UCRL-51877) Avail: NTIS HC $4.00

General features of a vapor-droplet flow are discussed and the equations expressing the conservation of mass, momentum, and energy for the vapor, liquid, and mixture using the control volume approach are derived. The phenomenological laws describing the exchange of mass, momentum, and energy between phases are also reviewed. The results have application to development of water dominated geothermal resources. Author (NSA)

N76-23525# Northwestern Technological Inst., Evanston, Ill.
LIQUID-LIQUID SURFACE IMPACTION Progress Report, 1 Jul. 1975 - 30 Sep. 1975
S. G. Bankoff 1975 20 p refs
(Contract AT(11-1)-2512)
(NU-2512-4) Avail: NTIS HC $4.50

When a cold volatile liquid droplet approaches the surface of a hot liquid pool, coalescence or rebound may occur. Coalescence may be followed by explosive boiling. Previous experiments have verified that the probability of coalescence depends on the Weber number, the temperature difference between the cold and the hot liquids, the drop diameter, and the nature of the two liquids. In this work the slow viscous flow equations for the air film, coupled with the momentum balance for the droplet, are used to derive an ordinary differential equation for the film thickness as a function of time in a three-phase, unsteady nonisothermal system. It is shown that the Stefan-Reynolds equation and the equations for steady Leidenfrost boiling of a droplet are special cases of the present analysis. An empirical relationship between the minimum thickness of the air film and the system parameters was found, using experimental results for Freon and pentane impacting on silicone oil. Author (ERA)

N76-23526# Naval Postgraduate School, Monterey, Calif.
ON THE STABILITY OF POISEUILLE FLOW
William Francis Harrison Sep. 1975 163 p refs
(AD-A018304) Avail: NTIS CSCL 20/4

The three-dimensional linearized vorticity transport equations for plane and pipe Poiseuille flow were studied using a highly generalized complex exponential form of solution in both space and time. The stability of these flows was examined using frames of reference which move with the fluid particles. Numerical results for plane Poiseuille flow show that the critical Reynolds number is lowered by the introduction of streamwise spatial decay. This result provides a new basis for improving the agreement between theory and experiment. Numerical results for pipe flow were not obtained due to a probable error in some detail of the analysis or numerical method. Author (GRA)

N76-23527# British Columbia Univ., Vancouver. Dept. of Geophysics and Astronomy.
EXPERIMENTAL VERIFICATION OF THE INERTIAL OSCILLATIONS OF A FLUID IN A CYLINDER DURING SPIN-UP Final Report
K. D. Aldridge Nov. 1975 42 p refs
(Contract DAAD05-74-Q-5383; DA Proj. 1W1-61102-AH-43)
(AD-A018797; BRL-CR-273) Avail: NTIS CSCL 19/1

The dependence of inertial oscillation frequency on time since a cylindrical container began rotating from rest is established experimentally for several axially symmetric modes of oscillation. The oscillations were excited by including a sinusoidal perturbation in the rotation speed of the container which served to establish an exchange of fluid between the viscous boundary layers and the interior. The interior is set into oscillation by the boundary layer flow and the resulting axial pressure differences are used to establish the amplitude of the inertial oscillation. GRA

N76-23528# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
THE IMPACT PRESSURE DISTRIBUTION OF A HYPERVELOCITY RAINDROP
B. R. Mullinix, W. F. Ranson (Auburn Univ.), and W. F. Swinson (Auburn Univ.) 22 Sep. 1975 51 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A018747; RL-76-6) Avail: NTIS CSCL 20/11

The theory relating the impact pressure on the surface of a solid to the optical holographic fringe patterns is presented. The experimental system used to obtain the fringe patterns is presented and discussed. A water jet gun was used to obtain the hypervelocity water drop impacts, and a discussion of its validity as a simulation technique is discussed. The impact velocity of

the jet was measured by breaking two laser beams a known distance apart, and was found to be 4900 ft/sec. The impact pressure distribution was determined and the maximum pressure was found to be at the center of impact. A ruby laser was used to illuminate the jet, and the 10 photographs taken at 10-microsecond intervals are presented. The variation in the size of the pressure zone as a function of time is shown. The impact pressure as a function of time is presented graphically. GRA

N76-23529# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
LIQUID FILM THICKNESS MEASUREMENTS IN UNIVERSITY OF MICHIGAN WET STEAM TUNNEL
F. G. Hammitt, J. B. Hwang, and W. Kim Dec. 1975 18 p refs
(Grant NSF G-40130)
(PB-247804/8; UMICH-012449-23-1) Avail: NTIS HC $3.50 CSCL 20D

The initial results from the wet-steam flow research program at the University of Michigan were described previously. The program is concerned with the behavior and stability of thin liquid films upon simulated turbine blades under high velocity steam flow, and their subsequent breakup into liquid droplets, which are then entrained into the wake, giving rise to an erosion problem in the next downstream rotating row. The problem of thin liquid film behavior in the nonadiabatic case has application also to problems of 'dry-out' in high void fraction boiling, particularly with regard to emergency core cooling of liquid-cooled nuclear reactors. GRA

N76-23530# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
PERFORMANCE OF CAVITATING VENTURI DEPENDING ON GEOMETRY AND FLOW PARAMETERS
F. G. Hammitt, O. S. M. Ahmed, and J. B. Hwang Nov. 1975 13 p refs
(Grant NSF G-40130)
(PB-247803/0; UMICH-012449-20-1-Mod-1) Avail: NTIS HC $3.50 CSCL 20D

The venturi is an important component in many liquid flow systems, used for flow measurement, as well as for cavitation research. Also, cavitating venturis can provide a choked flow regime useful for flow regulation. For all applications it is important to know the system head loss (loss coefficient) caused by the presence of the venturi, and the cavitation 'sigma' corresponding to cavitation inception or more advanced degrees of cavitation. These factors obviously depend upon flow parameters such as Reynolds' number, but also most heavily upon venturi geometry. Data from different venturi geometries are compared in order to understand further the effects of venturi geometry and other pertinent factors. GRA

N76-23531# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
HIGH SPEED IMPACT BETWEEN CURVED LIQUID SURFACE AND RIGID FLAT SURFACE
J. B. Hwang and F. G. Hammitt Oct. 1975 50 p refs Sponsored in part by the Alcoa Found.
(Grant NSF GK-40130)
(PB-247369/2; UMICH-012449-10-T) Avail: NTIS HC $4.00 CSCL 20D

The impact process of a cylindrical, a spherical and a conical water drop upon a rigid plane is studied with numerical methods. Time variation of drop cross section, pressure and velocity distribution are presented. The maximum pressure remained at the center of the contact area for the cylindrical drop, but followed outward with the edge of the contact area for the spherical and conical drops. The peak pressure for both cylindrical and conical drop reached approximately the value predicted by a one-dimensional analysis. The pattern of pressure distribution on the liquid-solid boundary compared favorably with the existing experimental data. Author

N76-23532# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
ON LIQUID-SOLID IMPACT PHENOMENA
J. B. Hwang Dec. 1975 18 p refs
(Grant NSF G-40130)
(PB-247801/4; UMICH-012449-24-1) Avail: NTIS HC $3.50 CSCL 20D

It is well accepted that when the motion of a liquid body is interrupted abruptly, such as occurs during sudden stoppage of a valve in a pipeline system or the collision between a liquid slug and a solid surface, a transient pressure rise of the order of the water-hammer pressure will be generated, if the solid is rigid. If the deformability of the solid is taken into account, the impact pressure is lower than that predicted from the water hammer equation. GRA

N76-23533# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
THE INFLUENCE OF VARIABLE VISCOSITY DUE TO LARGE TEMPERATURE DIFFERENCES ON THE ONSET OF CONVECTION IN POROUS MEDIA
D. R. Kassoy and A. Zebib 16 May 1975 21 p refs
(Grant NSF AER-74-03429)
(PB-247191/0; CUMER-75-4; NSF/RA/N-75-125) Avail: NTIS HC $3.50 CSCL 20D

The onset of convection in a horizontal, isotropic, water saturated porous medium is considered. The temperature difference between the top and bottom is as large as 250C. The effects of an 8-fold variation in kinematic viscosity are included. The critical Rayleigh number is found to be substantially reduced from the classical value although the associated wave number is nearly the same. Neutral mode streamline and isotherm patterns are considerably distorted in the vertical direction in distinction to the symmetric patterns found in the constant viscosity classical calculation. GRA

N76-23534# Cincinnati Univ., Ohio. Dept. of Chemical and Nuclear Engineering.
EVALUATION OF PRESSURE DROP ACROSS AREA CHANGES DURING BLOWDOWN Quarterly Progress Report
Sep. 1975 20 p refs
(Contract E(11-1)-2152)
(PB-247784/2; NUREG-75/085) Avail: NTIS HC $3.50 CSCL 18I

During these blowdown runs, two phase pressure drop will be measured across area changes and selected fittings. Test results will be compared with calculations. Steady state experiments will be performed as required to provide a data base for the transient studies and for instrumentation calibration purposes. GRA

N76-23535# Advisory Group for Aerospace Research and Development, Paris (France).
IMPROVED NOZZLE TESTING TECHNIQUES IN TRANSONIC FLOW
F. Jaarsma (Natl. Aerospace Lab., Amsterdam) Feb. 1976 16 p refs
(AGARD-AR-94) Avail: NTIS HC $3.50

Summary and conclusions are presented on the tests and joint analyses performed on nozzle testing techniques. Effects of wind tunnel static pressure, Reynolds Number, boundary layer, model support, wall interference, buoyancy, afterbody geometry, nozzle pressure ratio, and jet temperature are reported. Author

N76-23536# Advisory Group for Aerospace Research and Development, Paris (France).
FLOW SEPARATION
Feb. 1976 40 p refs Presented at the AGARD Fluid Dyn. Panel Symp., Goettingen, Germany, 27-30 May 1975
(AGARD-CP-168-Suppl) Avail: NTIS HC $4.00

The calculation is discussed of laminar separation which has always represented one of the most relevant problems of boundary layer theory, even within the classical Prandtl's assumption of vanishing transverse pressure gradients. Recent theories attempting to calculate separation after relaxing Prandtl's assumption are reviewed. Purely numerical results based on the finite difference solution of the complete Navier-Stokes equations are briefly mentioned. The analytical procedure based on a multiple layer treatment developed independently by Neiland and by Stewartson and Williams is discussed in detail both in the foundations and in the developments. Some as yet unmentioned results are also

given. A critical discussion follows, showing the insufficiency of the present asymptotic treatment of the return flow. A third procedure is thought to present a certain interest, that is the generalization of von Karman momentum integral procedure taking into account the existence of transverse pressure gradients. The attempt by Holden and Moselle, containing some arbitrariness, is mentioned. It is shown how the arbitrary elements can be removed and a perfectly coherent set of equations in integral form obtained. The possibility is shown of a fundamental improvement in the calculation of the distributions through the use of a three or four-parameter family of generalized similar solutions taking into account the transverse variability of the pressure. Author

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-23537 British Library Lending Div., Boston Spa (England).
HOMOGENOUS PHOTOGRAPHIC EMULSIONS
Yu. A. Breslav et al Dec. 1975 42 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 19, no. 4, 1974 p 296-316
(BLL-RTS-9862) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 40 BLL photocopy coupons

A review of the principles and techniques of controlled crystallization of silver halides used for homogeneous photographic emulsions was presented. The following conclusions were given: (1) homogeneous emulsions have better photographic properties than heterogeneous emulsions, (2) the principal consequence of homogeneous emulsions is their greater stability compared with heterogeneous emulsions, (3) homogeneous emulsions are often very suitable models for resolving a number of fundamental questions in the theory of the photographic process in silver halide microcrystals, (4) the use of two-stream emulsification methods makes possible the continuous synthesis of photoemulsions and the full automation of the process. Author

N76-23538 British Library Lending Div., Boston Spa (England).
AN ARTIFICIAL LIGHT SOLAR RADIATION RECORDER TESTING APPARATUS (INTEGRATING SPHERE PRINCIPLE)
Masayuki Sekine [1975] 19 p refs Transl. into ENGLISH from Japan Met. Agency Weath. Serv. Bull. (Tokyo), v. 39, 1972 p 113-120
(BLL-M-23827-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Solar radiation recorders can be classified broadly into two types; namely, recorders of direct solar radiation and those of global solar radiation. The solar radiation energy absorbed by a sensing element is converted into thermal energy, which is measured as a nonelectrical quantity by a thermometer or a bimetal thermometer, or as an electrical quantity by a thermocouple or a thermister, etc. A quantity, which was measured, must be converted into a unit of thermal energy. Such a conversion factor is called an instrument constant or a test constant and the operation carried out for this purpose is the testing of a solar radiation recorder. Author

N76-23539*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFRARED PYROMETER FOR HIGH RESOLUTION SURFACE TEMPERATURE MEASUREMENT ON ROTATING TURBINE BLADES
Orlando W. Uguccini 1976 20 p ref Presented at the Laser and Electro-Optical Systems Conf., San Diego, Calif., 25-27 May 1976; sponsored in cooperation with IEEE and Opt. Soc. of Am.
(NASA-TM-X-73414; E-8613) Avail: NTIS HC $3.50 CSCL 14B

A high resolution pyrometer was developed and used to obtain temperature profiles of rotating turbine blades at tip speeds up to 366 meters per second. Surface temperature variations from 920 to 1250 K can be measured and variations over distances of 0.05 cm can be resolved. Temperature profiles were obtained in near real time as hard copies from a computer display terminal. Temperatures measured with the prototype pyrometer and with thermocouples agreed to within 2 percent over the temperature range from 977 to 1144. Author

N76-23540*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
MULTIPLE DETECTOR FOCAL PLANE ARRAY ULTRAVIOLET SPECTROMETER FOR THE AMPS LABORATORY Final Report
Paul D. Feldman 30 Nov. 1975 50 p refs
(Contract NAS8-31413)
(NASA-CR-144309) Avail: NTIS HC $4.00 CSCL 14B

The possibility of meeting the requirements of the amps spectroscopic instrumentation by using a multi-element focal plane detector array in a conventional spectrograph mount was examined. The requirements of the detector array were determined from the optical design of the spectrometer which in turn depends on the desired level of resolution and sensitivity required. The choice of available detectors and their associated electronics and controls was surveyed, bearing in mind that the data collection rate from this system is so great that on-board processing and reduction of data are absolutely essential. Finally, parallel developments in instrumentation for imaging in astronomy were examined, both in the ultraviolet (for the Large Space Telescope as well as other rocket and satellite programs) and in the visible, to determine what progress in that area can have direct bearing on atmospheric spectroscopy. Author

N76-23541# National Highway Traffic Safety Administration, Washington, D.C.
HOLOGRAPHIC TECHNIQUES FOR NONDESTRUCTIVE TESTING OF TIRES Interim Report
Harry L. Ceccon Apr. 1972 67 p
(DOT-HS-820-227; DOT-TSC-NHTSA-72-4) Avail: NTIS HC $4.50

Holographic interferometric techniques were used to evaluate the feasibility of the technique in the nondestructive testing (NDT) of commercial automobile tires. Passenger tires with built-in defects were holographically inspected to determine the types of tire defects that can be detected using this method. Separations and voids were located reliably. Defects other than separations and voids were detected in some cases. Author

N76-23542*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-RESOLUTION SURFACE TEMPERATURE MEASUREMENTS ON ROTATING TURBINE BLADES WITH AN INFRARED PYROMETER
Orlando W. Uguccini and Frank G. Pollack Washington May 1976 20 p refs
(NASA-TN-D-8213; E-8613) Avail: NTIS HC $3.50 CSCL 14B

A high-resolution pyrometer was developed and tested on a modified turbine engine. The pyrometer was used to obtain temperature profiles of the viewed surface of turbine blades in the engine at tip speeds up to 366 meters per second. The combination of coherent fiber optics, a silicon avalanche detector, and high-speed electronics enabled surface resolution of a spot diameter of 0.05 centimeter. The data, in the form of temperature profiles, was obtained in near real time as a hard copy output from a computer display terminal. Temperatures measured with the pyrometer and with thermocouples agreed within 2 percent at temperatures between 977 to 1144 K. Author

N76-23543*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TRANSFORMATION METHOD FOR DERIVING FROM A PHOTOGRAPH, POSITION AND HEADING OF A VEHICLE IN A PLANE
Robert K. Sleeper and Eunice G. Smith Washington May 1976 49 p refs HC $4.00

(NASA-TN-D-8201; L-10411) Avail: NTIS CSCL 14E

Equations have been derived that transform perspectively viewed planar surface coordinates, as seen in a photograph, into coordinates of the original plane surface. These transformation equations are developed in terms of nine geometric variables that define the photographic setup and are redefined in terms of eight parameters. The parameters are then treated as independent quantities that fully characterize the transformation and are expressed directly in terms of the four corner coordinates of a reference rectangle in the object plane and their coordinates as seen in a photograph. Vehicle position is determined by transforming the perspectively viewed coordinate position of a representative vehicle target into runway coordinates. Vehicle heading is determined from the runway coordinates of two vehicle target points. When the targets are elevated above the plane of the reference grid, the computation of the heading angle is unaffected; however, the computation of the target position may require adjustment of two parameters. Methods are given for adjusting the parameters for elevation and an example is included for both nonelevated and elevated target conditions. Author

N76-23544*# Battelle Columbus Labs., Ohio.
HOLOGRAPHIC RECORDING MATERIALS DEVELOPMENT
C. M. Verber, R. E. Schwerzel, P. J. Perry, and R. A. Craig 23 Mar. 1976 99 p refs
(Contract NAS1-13834)
(NASA-CR-144991) Avail: NTIS HC $5.00 CSCL 14E

Organic photorefractive materials were evaluated for application in a reversible holographic memory system. Representative indigo and thioindigo derivatives and several stilbene derivatives were studied as well as 15, 16-dialkyldihydropyrene derivatives the following goals were achieved: (1) the successful writing of phase holograms in a thioindigo/polymer gel system, (2) the successful writing and erasing of phase holograms in a variety of indigo/polymer gel and indigo/solid polymer systems, and (3) the identification of indigoid dyes and 15, 16-dialkyldihydropyrene derivatives as materials potentially suitable for utilization in an operational system. Photochemical studies of the stilbene, indigo, thioindigo, and dialkyldihydropyrene derivatives in solution and in a variety of polymer matrix materials were conducted with the goal of optimizing the photorefractive behavior of the chemical system as a whole. The spectroscopic properties required of optimal photorefractive materials were identified, and it was shown that both the indigoid dyes and the dialkyldihydropyrenes closely match the required properties. Author

N76-23545# Oak Ridge National Lab., Tenn.
ELECTROMAGNETIC TRANSDUCER FOR GENERATION AND DETECTION OF BOTH LONGITUDINAL AND TRANSVERSE ULTRASONIC WAVES
K. Kawashima Sep. 1975 20 p
(Contract W-7405-eng-26)
(ORNL-5064) Avail: NTIS HC $4.00

An electromagnetic ultrasonic transducer that generates and detects both longitudinal waves and radially polarized transverse waves was made and tested on aluminum, brass, copper, and mild steel. The transducer detected an artificial flaw in aluminum with a fairly good signal-to-noise ratio. It was also shown experimentally with the electromagnetic transducer that the mode conversion between a longitudinal wave and a radially polarized transverse wave occurs with a fairly good efficiency at the vertical reflection. Author (ERA)

N76-23546# Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Recherche Scientifique.
TIME-OF-FLIGHT MASS SPECTROMETERS WITH PARTICLE GUIDE
R. Igersheim, J. Ch. Abbe, and J. M. Paulus 1973 19 p refs In FRENCH
(CRN-CNPA-75-11) Avail: ERDA Depository Libraries HC $4.50

Two time of flight mass spectrometers were designed. The first one consists of an arrangement of a pulsed ion source, an electrostatic particle guide and a detector; an ion reflector was added in the second apparatus. The supply of a particle guide appears to be particularly efficient in the second case for the analysis of low energy beams. The higher the initial kinetic energy of the ions, the more important is the corresponding increase in sensitivity. Author (ERA)

N76-23547# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.
DETECTOR SENSITIVITY AND SITING REQUIREMENTS FOR DWELLING Final Report
R. W. Bukowski, T. E. Waterman, and W. J. Christian 1975 337 p refs Sponsored by NBS
(PB-247483/1; IITRI-J6340-FR; NBS-GCR-75-51) Avail: NTIS HC $10.00 CSCL 13B

A test program was undertaken to investigate the operation of residential smoke detectors under actual field conditions. The main objectives were to determine: (1) minimum sensitivity; (2) best location; and (3) escape time provided by a group of typical detectors. Instrumentation was used to determine theoretical response times of an ideal detector as a base line for evaluation of detector performance. The tests were conducted using smouldering or flaming ignition of sofas, chairs and mattresses in various rooms in two abandoned, single-family houses scheduled for demolition. Work was carried out during winter and summer seasons with central heating and cooling on and off. GRA

N76-23548# Pennsylvania State Univ., University Park. Applied Research Lab.
NEAR-FIELD CALIBRATION OF UNDERWATER ELECTROACOUSTIC TRANSDUCERS Ph.D. Thesis
Robert D. Marciniak 16 Sep. 1975 130 p refs
(Contract N00017-73-C-1418)
(AD-A018460; TM-75-224) Avail: NTIS CSCL 20/1

A near-field acoustic measurement technique which provides the basis for accurately computing the far-field radiation characteristics of underwater sound transducers is developed, implemented and evaluated. The analysis is based on evaluating a form of the Helmholtz integral which utilizes a Green's function with particular boundary conditions for the solution. That is, the Green's function vanishes over the surface of integration, thereby requiring only knowledge of the near-field acoustic pressure for computing the far-field radiation. An experimental program is conducted to provide corroboration of the near-field technique. Design and construction details of the completely automated near-field measurement system, including the near-field acoustic sensors, the pulsed Amplitude-Phase electronic measurement system, and the Digital Scanner System are presented. Appropriate supporting software, in the form of a digital computer program, is provided for performing the data preparation and final far-field computations. Results of conventional far-field acoustic measurements at various frequencies on four different types of test transducers are presented. GRA

N76-23549# ARO, Inc., Arnold Air Force Station, Tenn.
CHARACTERISTICS OF THE HOLOGRAPHICALLY RECONSTRUCTED IMAGE OF A POINT SOURCE OF RADIATION Final Report, 1 Jul. 1974 - 31 Mar. 1975
R. W. Menzel AEDC Dec. 1975 18 p refs
(ARO Proj. B32S-04A)
(AD-A018692; ARO-OMD-TR-75-89; AEDC-TR-75-131) Avail: NTIS CSCL 20/6

The focal volume characteristics of an image obtained from the reconstruction of a hologram of a point source of radiation are described. The similarity between the reconstructed image and a point image obtained from a diffraction-limited lens is explained. The focal depth limitations of the reconstructed image are experimentally presented. GRA

N76-23550# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PRODUCTION OF DICHROMATED GELATIN EMULSIONS FOR RECORDING PHASE HOLOGRAMS M.S. Thesis
David A. Marcroft Dec. 1975 74 p refs
(AD-A019320; GEP/PH/75-18) Avail: NTIS CSCL 14/5

An experimental study was made to determine the optimum procedures for making dichromated gelatin plates suitable for creating phase holograms. It was determined that a 0.5mm thick coating of 3% gelatin solution (by weight) resulted in a dry film thickness of 10 micrometers. A procedure for allowing the

gelatin solution to solidify on a level plate at room temperature was used to coat the flat glass plate. This procedure was found to give excellent gelatin films which were then hardened in Kodak Rapid-Fixer and sensitized with a 5% solution of ammonium dichromate (by weight). The plates were then dried prior to exposure. Plane wave gratings were created in the sensitized gelatin using 5145 A light as a test of the processing procedures. It was found that during periods of high humidity, the diffraction efficiency continued to change after the exposure was stopped. This changing diffraction efficiency before processing was found to have some relationship to the amount of hardness of the water content of the plates. No precise relationship for these factors was determined. GRA

N76-23551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENCE ON THE CINEMA: GOALS AND PROSPECTS
V. Baskakov 3 Dec. 1975 12 p Transl. into ENGLISH from Sov. Kultura (USSR), no. 51, 25 Jun. 1974 p 3
(AD-A018897; FTD-ID(RS)I-2410-75) Avail: NTIS CSCL 14/5

The brief translation reviews the history and development of Soviet cinematography. GRA

N76-23552# ARO, Inc., Arnold Air Force Station, Tenn.
APPLICABILITY OF INFRARED SCANNING CAMERAS FOR THERMAL VACUUM TESTING IN THE 12 V AND MARK I CHAMBERS Final Report, 1 Jul. 1973 - 30 Jun. 1975
J. A. Roux AEDC Dec. 1975 41 p refs
(ARO Proj. VF470; ARO Proj. V355-62A)
(AD-A018655; ARO-VKF-TR-75-94) Avail: NTIS CSCL 14/5

The results of a study defining the applicability of infrared scanning cameras for thermal vacuum testing in the Aerospace Chamber (12V) and the Aerospace Environmental Center (Mark I) are presented. The infrared (IR) cameras were studied as an alternative or complement to the use of thermocouples for detecting test model hotspots or temperature maps. The infrared background noise sources of the chambers are defined along with their impact upon the cameras: performance and temperature-measuring accuracy. The infrared cameras are shown to be compatible with the SDS 9300 computer for digitizing and storing the camera data. Author (GRA)

N76-23553# Fairchild Space and Defense Systems, Syosset, N.Y.
ELECTRONIC SOLID STATE WIDE ANGLE CAMERA Final Report, Dec. 1973 - Jul. 1974
Henry W. Sadowski and Robert M. Sweet Nov. 1975 95 p
(Contract F33615-74-C-1109; AF Proj. 2004)
(AD-A018839; ED-AC-42; AFAL-TR-75-47) Avail: NTIS CSCL 14/5

The objective of this program was to develop a breadboard system to demonstrate the feasibility of a new class of reconnaissance camera, namely, a high resolution, low distortion, ultra-wide angle electronic image sensor matched to the silicon optical response spectrum and having no moving parts. To achieve this objective a prototype lens was developed in parallel with a technique for optically butting linear Charge Coupled Devices (CCD). A breadboard scanner/display was fabricated which served to demonstrate the achievement of the objective. Separate lens test results are included in the report. GRA

N76-23554# Illinois Univ., Urbana. Coordinated Science Lab.
THE ATOM PROBE FIELD ION MICROSCOPE: FUNDAMENTAL PRINCIPLES OF OPERATION Ph.D. Thesis
Robert Sloane Chambers Dec. 1975 209 p refs
(Contract DAAB07-72-C-0259; Grant NSF DMR-72-02937)
(AD-A019424; R-702; UILU-ENG-75-2237) Avail: NTIS CSCL 14/2

The ability of the Atom Probe to characterize the chemical composition of a surface with atomic resolution has been investigated. The experimental techniques necessary for quantitative surface studies are presented. GRA

N76-23316* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION SIGNAL POWER MEASUREMENT AND NOISE-ADDING RADIOMETER EQUIPMENT
L. C. Constenla *In its* The Deep Space Network 15 Apr. 1976 p 90-99 refs (For availability see N76-23304 14-12) CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-23555 State Univ. of New York, Stony Brook.
RAYLEIGH-BRILLOUIN SCATTERING IN GASES AND BINARY GASEOUS MIXTURES Ph.D. Thesis
Quoc-Huy Lao 1975 186 p
Avail: Univ. Microfilms Order No. 76-11727

A spherical Fabry-Perot interferometer (FPS) was used with a free spectral range of 2 GHz and a single-moded argon ion laser operating at 5145A to measure the spectra of light scattered by gases and gaseous mixtures. The FPS was piezoelectrically scanned by a sweep unit equipped with a zero-crossing discriminator and was synchronously connected to a multichannel scaler for repetitive scans. Temperature of the gas cell was controlled to within plus or minus 0.1 C at 25 C and 29 C. In order to study the Rayleigh-Brillouin scattering of gases of varying degrees of complexity, the spectra of scattered light from Kr, N2, CO2, C2F6 and C2H6 were observed. The pressures of the gas range from 0.1 to 18 atm so that theories for the hydrodynamic regime as well as those for the kinetic regime can be tested. Dissert. Abstr.

N76-23556 Cornell Univ., Ithaca, N.Y.
AN ELECTRICALLY DISCHARGED CARBON DISULFIDE-OXYGEN CHEMICAL LASER Ph.D. Thesis
Norman Arnold Nielsen, Jr. 1975 166 p
Avail: Univ. Microfilms Order No. 76-9553

Since 1966 several lasing systems have been developed which are based on the oxidation of CS2. Regardless of experimental configuration, the pumping reaction is as follows: O + CS yields S + CO(+). A pulsed electrical discharge through mixtures at 3-5 torr (10-20 He: 3-5 O2: 0.2-0.3 CS2) initiated the reaction under flow conditions. Distribution peaked at v = 13, in accord with observations of other laboratories, but also showed that substantial fractions were produced in the low v states. A comprehensive literature review was undertaken of C-S-O chemistry, and CO energy transfer processes. This material was assembled and inserted into a computer model. Tests of the model led to several conclusions: (1) eight reactions are sufficient to simulate the chemistry during the first 300 microsec after pulse initiation; (2) the reaction C + O2 yields O + CO may be partly responsible for the low level CO observed under high energy discharge conditions at 15 kV; (3) knowledge of the initial degrees of dissociation of the reactants is essential for accurate modeling; (4) temperature changes with time not only affect the overall chemistry, but particularly control the CO(+) relaxation; and (5) v-(v,T) rates play an important role in CO(+) relaxation, the most significant relaxers being O, O2, CS2, and OCS. Dissert. Abstr.

N76-23557 New York Univ., N.Y.
THEORY OF A HIGH INTENSITY GAS LASER Ph.D. Thesis
Jehuda Ziegler 1975 202 p
Avail: Univ. Microfilms Order No. 76-10241

A matrix formulation of coupled differential equations is used to convert the problem to that of solving a linear first order matrix differential equation with a periodic coefficent matrix. Physically acceptable solutions are the ones which satisfy periodic boundary conditions in the laser's axial direction. By converting the periodic boundary problem to an initial value problem a direct numerical solution is obtained using Runga-Kutta and predictor-corrector methods. A solution for general single mode operation is also given in terms of integral equations which are iterated to give analytic approximations and numerical solutions. For the special case of central tuning and equal level decay rates, and neglecting collision broadening, an exact solution is given in terms of a definite integral which is then integrated both analytically in terms of Bessel functions and numerically. Dissert. Abstr.

N76-23558*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORY OF LOW TRANSITIONS IN CO DISCHARGE LASERS

Barry D. Sidney, Roy M. McInuille, Neill S. Smith, and H. A. Hassan Washington May 1976 70 p refs

(NASA-TN-D-8181; L-10589) Avail: NTIS HC $4.50 CSCL 20E

A self consistent theoretical model which couples the electron and heavy particle finite rate kinetics with the optical and fluid dynamic processes has been employed to identify the various parameters and explain the mechanism responsible for producing low lying transitions in slow flowing CO lasers. It is found that lasing on low lying transitions can be achieved at low temperatures for low pressures (or low flow rates) together with high partial pressures of the He and N2. The role of N2 has been identified as an additive responsible for reducing the electron temperature to a range where the transfer of electrical power to the lower vibrational modes of CO is optimum. Author

N76-23559# California Univ., Livermore. Lawrence Livermore Lab.

ANALYSIS OF EFFICIENT IMPULSE DELIVERY AND PLATE RUPTURE BY LASERSUPPORTED DETONATION WAVES

N. Ferriter, D. E. Maiden, A. M. Winslow, and J. A. Fleck, Jr. 2 Jun. 1975 29 p refs

(Contract W-7405-eng-48)

(UCRL-51836) Avail: NTIS HC $4.00

Determination of laser beam parameters for damage of a given target is treated in two steps: (1) By means of a simple hydrodynamic relaxation model coupled with impulse scaling laws it is shown how to optimize the laser pulse length in order to maximize coupling efficiency (impulse delivered/laser pulse energy) or impulse delivered to a target; (2) An analytic model for the rupture of a thin plate is then derived relating the impulse at failure to the plate's geometry and material properties. Combining these two models yields a two-parameter family of curves for the design of a laser intended to rupture a given thin target; i.e., any two beam or target parameters completely determine all the others for a beam operating at maximum efficiency. Typical design curves are presented showing laser-beam pulse lengths, intensities, energies, and radii required to rupture various thin aluminum and stainless steel plates. Predictions from these models are verified by computational results obtained from two-dimensional finite difference and finite element codes. Results from the thin-plate rupture analysis are shown to agree with experimental measurements on impulsively loaded thin plates. Author (ERA)

N76-23560# Addis Translations International, Portola Valley, Calif.

INTERACTION OF A HIGH-POWER LASER BEAM WITH AN LiD TARGET

L. V. Dubovoi, V. D. Dyatlov, V. I. Kryzhanovskii, A. A. Mak, R. N. Medvedev, A. N. Popytaev, V. A. Serebryakov, V. N. Sizov, and A. D. Starikov Sep. 1975 16 p refs Transl. into ENGLISH from the Russian preprint T-0185 Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.

(UCRL-Trans-10942; T-0185; NP-20299) Avail: NTIS HC $4.50

The parameters of a plasma produced by a high-power Nd glass laser irradiating an LiD target is presented. Neutron yields of up to 6,000,000 neutrons/4 pi and electron temperatures of 1 to 2 keV were measured. The reflection coefficient was found as a function of the incident beam intensity. This relationship cannot be explained by a classical interaction mechanism.

Author (ERA)

N76-23561# California Univ., Berkeley. Lawrence Berkeley Lab.

FEASIBILITY AND ADVANTAGES OF OFF-RESONANCE LASERS IN CHEMICALLY REACTING SYSTEMS

C. B. Harris Jun. 1975 15 p refs Presented at the 27th Internl. Meeting of the Societe de Chimie Phys., Paris, 17 Jun. 1975

(Contract W-7405-eng-48)

(LBL-3916; Conf-750683-1) Avail: NTIS HC $4.00

The problem of understanding the semiclassical description of the time evolution of an ensemble of two state systems under the influence of a coherent radiation field is of considerable importance. A closed form solution that includes the effects of relaxation and spontaneous emission between the two levels has been obtained for the general case when the ensemble is being incoherently fed from a population reservoir, as would be the case, for example, in a chemical laser. In addition to providing a basis for understanding the modifications which occur for such a system, the mathematical formulation predicts that an important effect may be observed. This effect, which is termed kinetic coherence, is the production of a long term coherent component that results directly from the kinetic feeding. The magnitude of the component is related to the rate of creating excited states, relaxation pathways and the off-resonance frequency.

Author (NSA)

N76-23562# California Univ., Livermore. Lawrence Livermore Lab.

ELECTRON-BEAM PUMPING OF VISIBLE AND ULTRAVIOLET GAS LASERS

L. P. Bradley 12 Sep. 1975 100 p refs Presented at the Proc. on the Physics and Tech. of High Power Gas Lasers, Capri, Italy, 22 Sep. 1975 Sponsored by ERDA

(UCRL-77213; Conf-750970-1) Avail: NTIS HC $8.00

Several techniques for using direct electron pumping of gas lasers are reviewed. The primary objective is to categorize pump geometries and to give guidelines for gun selection and pulser design. Examples and application of pump technology are given.

Author (NSA)

N76-23563# Sandia Labs., Albuquerque, N.Mex.

LASER VELOCIMETER DATA ACQUISITION, PROCESSING, AND CONTROL SYSTEM

R. J. Croll, Jr. and C. W. Peterson 1975 8 p refs Presented at 6th Intern. Congr. on Instrumentation in Aerospace Simulation Facilities, Ottawa, 22 Sep. 1975 Sponsored by ERDA

(SAND-75-5415; Conf-750919-2) Avail: NTIS HC $4.50

The use of a mini-computer for data acquisition, processing, and control of a two-velocity-component dual beam laser velocimeter in a low-speed wind tunnel is described in detail. Digital stepping motors were programmed to map the mean-flow and turbulent fluctuating velocities in the section boundary layer and free stream. The mini-computer interface controlled the operation of the LV processor and the high-speed selection of the photomultiplier tube whose output was to be processed. A statistical analysis of the large amount of data from the LV processor was performed by the computer while the experiment was in progress. The resulting velocities are in good agreement with hot-wire survey data obtained in the same facility.

Author (ERA)

N76-23564# RCA Labs., Princeton, N.J.

INJECTION LASERS FOR HIGH DATA RATE OPTICAL COMMUNICATIONS, VOLUME 2 Final Report, 1 Jan. - 30 Sep. 1975

I. Ladany, J. P. Wittke, and H. Kressel Oct. 1975 88 p refs

(Contract N00014-73-C-0335)

(AD-A018358; PRRL-75-CR-0335-Vol-2) Avail: NTIS CSCL 20/5

An outline is given of the basic parameters which control the operation and life expectancy of CW laser diodes. This includes a different approach to the laser design problem than that generally used and leads to a modified expression for the threshold current density. Results of this analysis are used to develop a CW laser structure that combines a low threshold with a low vertical beam spread, the latter being essential to the achievement of low coupling losses needed in fiber-optic communication systems. Other design requirements are reviewed, and electrical and optical performance data of lasers developed under this contract are presented. Based on extensive experimental measurements, the reliability aspects of CW lasers are discussed. Facet erosion is shown to be a major failure mode, and methods are given for limiting the influence of this effect. With a suitable coating applied to the facet, lasers fabricated during this contract have accumulated 6,000 hours of life without significant output decrease. Similar lasers, without facet protection, have accumulated more than 10,000 hours of operating time with output decreasing gradually, as a consequence of facet erosion. A laser

system has been developed, which includes thermal stabilization utilizing thermoelectric coolers and fan cooling for heat removal from the hot end of the thermoelectric module. Convection cooling for that purpose has been demonstrated to be adequate under less extreme ambients. GRA

N76-23565# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
MILLIMETER WAVE DYNAMIC IMAGING Final Report, 1 Apr. 1971 - 31 Dec. 1974
D. H. Ulmer, O. P. Gandhi, and R. W. Grow Aug. 1975 38 p refs
(Grant DA-ARO(D)-31-124-71-G111)
(AD-A018851; UTEC-MD-75-109; ARO-9486.4-EL) Avail: NTIS CSCL 20/6

The objective of the project was to conduct a feasibility study on a device to convert millimeter wave images into visible pictures. The planar Fabry-Perot interferometer (FPI) was studied theoretically and experimentally for the passage of millimeter wave beams through it. Experiments showed that millimeter wave images pass through the FPI with little alteration of the intensity profile. The field enhancing effects of the FPI are needed to increase upconversion efficiency of millimeter wave images to visible pictures. Theoretically the passage of an arbitrary field distribution (image) through an FPI can be understood in terms of the transverse modes of the FPI. The diffraction effects were properly included for the various modes in order to obtain the intensity profile at the output. The property of an FPI to act as a spatial band pass filter was pointed out. Experiments were performed to demonstrate spatial filtering characteristics. GRA

N76-23566# Sperry Univac, St. Paul, Minn. Applied Physics Lab.
MAGNETO-OPTIC LASER BEAM STEERING Technical Report, 1 Mar. 1974 - 1 Mar. 1975
T. R. Johansen, F. G. Hewitt, J. Krawczak, and E. J. Torok Oct. 1975 75 p refs
(Contract F33615-74-C-1035; AF Proj. 2001)
(AD-A018983; AFAL-TR-75-122) Avail: NTIS CSCL 20/6

An effort to apply magneto-optic laser beam steering to laser recording has been conducted. The approach is based on diffraction of laser beams by stripe domains which exist in bismuth ytterbium iron garnet crystals (BiYbIG). The preparation of BiYbIG crystals by liquid phase epitaxy is complicated by a surprisingly large thermal expansivity of the bismuth substituted garnet. Special substrates, graded interfaces, top seeded rods, bulk crystals, and LPE on very thin (10 micrometer) substrates were tested as a means of crystal fabrication. LPE on very thin substrates appears to be the single best short term approach. With this method, lead free, crack free, high bismuth content garnets were for the first time grown by liquid phase epitaxy. At this time, high inductance (approximately 400 (mu)H) drive coils are required to generate the drive field. An azimuth scan uses a resonant circuit but requires a 25-30 Oe field for scan initiation and so wastes spots. The radial scan uses all of the spots but requires a broad band drive circuit, which limits the number of lines available at 30 frames per sec. When LPE BiYbIG crystals are prepared free of misfit dislocations by making the in-plane lattice match perfect, then the drive requirements will be reduced, and then all of the device goals of the laser recording application can be met or surpassed with the magneto-optic beam steering approach. GRA

N76-23567# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECTS OF SURFACE STRUCTURAL PROPERTIES ON LASER-INDUCED DAMAGE AT 1.06 MICROMETERS Ph.D. Thesis. Final Report, 1973-1975
Richard A. House, II 12 Dec. 1975 156 p refs
(AF Proj. 8809)
(AD-A019325; DS/PH/75-4) Avail: NTIS CSCL 20/6

Short-pulse, laser-induced breakdown has been correlated with several surface properties and preparation techniques, for five transparent dielectric materials: Fused Silica, BK-7, ED-2, ED-4, and Cervit. The laser parameters were: 1.06 micrometers wavelength, 40 ns pulse width, TEM sub 00 mode, and 147 micrometer spot size. Damage threshold correlated strongly with RMS surface roughness, and measurements of roughness can be used to predict the threshold. Threshold was not affected by grinding procedure. Surfaces overcoated with thin dielectric films had reduced thresholds. Flame-polished and ion-polished surfaces had greatly increased thresholds. Surface contamination by rouge polishing compound caused a drastic threshold reduction at a wavelength of 1.06 micrometers. Nitric acid etching increased damage threshold. Ultrasonic cleaning could increase surface roughness and reduce threshold. The technique of roughness-normalization facilitates the comparison of various surface preparation techniques. GRA

N76-23568# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENTS OF WATER-VAPOR TRANSITIONS IN THE VICINITY OF 5.35 MICRONS WITH A TUNABLE SPIN-FLIP RAMAN LASER Ph.D. Thesis
William A. Wallace Dec. 1975 140 p refs
(AF Proj. 2001)
(AD-A019327; DS/PH/75-6) Avail: NTIS CSCL 20/6

Tunable infrared laser spectroscopy of atmospheric water vapor has been carried out at 5.35 micrometers using a Raman spin-flip laser as a tunable source. A Raman spin-flip laser was operated in the mode controlled region to produce the narrowest possible line width. Several of the pressure broadened line widths of the 6.3 micrometers nu sub 2 fundamental band of water vapor were measured. The measured line widths were found to be slightly narrower than the theoretically calculated widths of Benedict and Calfee. These results support the findings of others and indicate absorption coefficients at the line centers that are larger than those indicated by the calculated parameters. These discrepancies have important implications concerning the transmittance of the atmosphere at or near the water vapor lines measured. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-23569 British Library Lending Div., Boston Spa (England).
ELECTROSTATIC POWDER LACQUERING FOR PANELS OF VENEER AND MOULDED LAMINATED PLASTIC
H. H. Reinsch Dec. 1975 7 p Transl. into ENGLISH from Fette-Seifen-Anstrichm. (West Germany), v. 77, no. 2, 1975 p 68-70
(BLL-RTS-10074) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

Surface finishing for furniture using powdered laquer is reviewed. Suitable carrier materials for powder lacquer, preparation of lacquer coatings, and kinds of powder and film formation are discussed. F.O.S.

N76-23570* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING AN APERTURED CASTING Patent
Andrew Terray, inventor (to NASA) Issued 18 May 1976 4 p Filed 27 Feb. 1974 Supersedes N74-18131 (12 - 09, p 1055)
(NASA-Case-LEW-11169-1; US-Patent-3,957,104; US-Patent-Appl-SN-446568; US-Patent-Class-164-132) Avail: US Patent Office CSCL 13H

An apertured casting is made by first forming a duplicate in the shape of the finished casting, positioning refractory metal bodies such as wires in the duplicate at points corresponding to apertures or passageways in finished products, forming a ceramic coating on the duplicate, removing the duplicate material, firing the ceramic in a vacuum or inert atmosphere, vacuum casting the metal in the ceramic form, removing the ceramic form, heating the cast object in an atmospheric furnace to oxidize the refractory metal bodies and then leaching the oxidized refractory bodies from the casting with a molten caustic agent or acid solution.
Official Gazette of the U.S. Patent Office

N76-23571 British Library Lending Div., Boston Spa (England).
LOST WAX PROCESS AND ITS PRODUCTS
D. Yoshida Mar. 1976 19 p Transl. into ENGLISH from

Chutanzo (Japan), v. 317, 1974 p 5-13
(BLL-RTS-10023) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

The lost wax process is described and its potential uses as a new type of casting technique for the manufacture of molded articles in Japan are discussed. A.L.

N76-23572 British Library Lending Div., Boston Spa (England).
DETERMINATION OF THE GEOMETRY OF THE DEFORMATION ZONE IN FLANGING TUBE ENDS WITH A ROLLER TOOL
I. N. Potapov, A. I. Aleksandrovich, E. I. Shifrin, and V. P. Zinov [1975] 12 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (Moscow), no. 7, 1975 p 96-98
(BLL-M-25258-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A method is proposed for determining the parameters of the deformation zone in flanging tube ends with a roller. Author

N76-23573 Mississippi State Univ., State College.
SENSITIVITY ANALYSIS IN TRANSIENT STABILITY OF MULTIMACHINE POWER SYSTEMS Ph.D. Thesis
Tsen-Yau Sung 1975 108 p
Avail: Univ. Microfilms Order No. 76-11811

In this dissertation only the first swing stability of power system is considered. Techniques of sensitivity analysis and Liapunov's second method are used to study the effects of parameter variation on the stability performance of a power system under the condition of a transient disturbance. A digital computer is used to perform the analysis. Results are presented for numerical examples of a one machine-infinite bus power system and a four-generator power system. Dissert. Abstr.

N76-23574 British Library Lending Div., Boston Spa (England).
PRESSURE PULSATION IN EXTERNAL AND INTERNAL GEAR PUMPS AND ITS EFFECT ON PUMP NOISE
W. Gutbrod 1975 19 p refs Transl. into ENGLISH from Oelhydraulik Pneumatik 19 (West Ger.), no. 4, 1975 p 250-257
(BLL-NEL-TT-2662-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

This contribution is based on the report on delivery flow from external and internal gear pumps and its irregularity. The connection between the pressure pulsation resulting from delivery flow irregularity and the production of noise is illustrated with reference to measurements of 10 external and 3 internal gear pumps. The tooth engagement frequency and the degree of irregularity turn out to be the dominant properties for the noise intensity level. The effect of increasing the speed of rotation is twice as great as the effect of increasing the pressure. No precise relationship of the pressure intensity level to the hydraulic output alone can therefore be quoted. Author

N76-23575 British Library Lending Div., Boston Spa (England).
LOADING OF GRINDING WHEELS (2)
H. Shigematsu Jan. 1976 17 p refs Transl. into ENGLISH from Seimitsu Kikai (Japan), v. 32, no. 8, 1966 p 577-584, 57-64
(BLL-RTS-8970) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

The following are discussed: (1) a method of calculating by means of scattering intensity the loading amount on a wheel face, and an examination of the loading amount obtained; (2) the correlation between the loading amount and the loading condition, taking into consideration that interactions between loading factors exert an influence on the loading conditions; and (3) microscopic observation of the size and shape of pores dotted across the wheel face. Author

N76-23576 British Library Lending Div., Boston Spa (England).
LOADING OF GRINDING WHEELS (4); EFFECT ON GRINDING WHEELS AND WORK MATERIALS ON LOADING
H. Shigematsu Dec. 1975 21 p refs Transl. into ENGLISH from Seimitsu Kikai (Japan), v. 33, no. 2, 1967 p 27-34
(BLL-RTS-8967) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

Experimental studies were carried out on the relationship between grinding wheels and quantities of loading, and on the relationship between work materials and conditions of loading. It was concluded that the quantities and conditions of loading on the worked wheel surface are changed considerably by the kind of abrasive material, the work material, and the grain size, grade, and structure of grinding wheel. Author

N76-23577 British Library Lending Div., Boston Spa (England).
ULTRASONIC TESTING OF NUCLEAR REACTOR PRESSURE VESSELS
K. Kolb and M. Woelfel [1975] 17 p refs Transl. into ENGLISH from Materialpruefung (Duesseldorf), vol. 17, no. 10, 1975 p 352-358
(BLL-Risley-Tr-2963-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

For the detection of sound plane flaws, vertically orientated to the surface, by the ultrasonic testing of reactor pressure vessels, the single-probe technique is supplemented by the tandem technique. The reliability of the test results is influenced by the nature of the internal plating, the choice of test frequency and the horizontal angular deviation of the flow in relation to the acoustic beam plane of the transmission channel. The effect of these factors has been studied. Proposals for reducing the effect of errors and in consequence improving the reliability of the results are discussed. Author

N76-23578 British Library Lending Div., Boston Spa (England).
IMPROVEMENT OF THE LIFE OF STEEL CABLES MADE FROM WIRE PRODUCED WITH A LUBRICANT CONTAINING MOLYBDENUM DISULPHIDE
M. G. Yunusov, D. I. Khromov, A. F. Karmadonov, O. A. Ryabchikova, and S. B. Shchurovskii 1975 10 p refs Transl. into ENGLISH from Stal (USSR), no. 7, 1975 p 636-638
(BLL-M-25251-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Experimental batches of cable were produced at the Magnitogorsk sizing works using wire drawn with up to 5-8% of molybdenum disulphide added to the standard lubricant. This wire had appreciably higher properties and ductility than wire drawn using soap alone as the lubricant. Increasing additions of MoS2 to above 8% provided no better effect. When certain experimental cables were produced MoS2 was also introduced in the cores and during winding of the strands and the cable itself. Tests made on bridge cranes, tilting winches, skip hoists and excavators show that the lives of the steel cables are increased by 30-160% over those of the standard cables. Author

N76-23579 British Library Lending Div., Boston Spa (England).
VALVES IN THE POWER ENGINEERING SECTOR
Karl Gruner 1975 7 p refs Transl. into ENGLISH from Brennstoff-WaermeKraft (Germany), v. 27, no. 4, Apr. 1975 p 180-182
(BLL-NEL-TT-2633-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The design of valves for power stations is discussed. Safety, steam pressure reduction, and switch-off throttle valves are briefly described. Low level noise valves are also described. F.O.S.

N76-23580 Tennessee Univ., Knoxville.
FRACTURE MECHANICS OF WELDMENTS USING FINITE ELEMENT ANALYSIS Ph.D. Thesis
Maher Younan Ayoub Younan 1975 138 p
Avail: Univ. Microfilms Order No. 76-11097

It has been established that weldments are non-homogeneous anisotropic materials. Hence, a new fracture criterion is necessary to predict critical directions for crack propagation as well as critical loads. The proposed criterion is that the crack will propagate in a direction so that the energy release rate is a maximum. The magnitude of the critical energy release rate is a material property. To utilize this criterion, a two dimensional finite element model is developed to determine the stresses in weldments. The weld metal is being treated as a non-homogeneous orthotropic material. Special crack tip triangular elements have been used to account for the singularity at the crack tip. Two techniques have been developed to model the virtual crack propagation direction: (1) the two node technique; and (2) the virtual displacement technique. Dissert. Abstr.

N76-23581*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

APOLLO TELESCOPE MOUNT: A PARTIAL LISTING OF SCIENTIFIC PUBLICATIONS AND PRESENTATIONS

John M. Reynolds, ed. and William C. Snoddy, ed. 15 Apr. 1976 74 p refs

(NASA-TM-X-73300) Avail: NTIS HC $4.50 CSCL 13I

A compilation of bibliographies from the principal investigator groups of the Apollo Telescope Mount (Skylab solar observatory facility) which gathered data from May 28, 1973, to February 8, 1974 is presented. The analysis of these data is presently under way and is expected to continue for several years. The publications listed are divided into the following categories: (1) Journal Publications, (2) Journal Publications Submitted, (3) Other Publications, (4) Presentations - National International Meetings, and (5) Other Presentations. An author index is also included. Author

N76-23582*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OIL-AIR MIST LUBRICATION AS AN EMERGENCY SYSTEM AND AS A PRIMARY LUBRICATION SYSTEM

William R. Loomis May 1976 19 p refs

(NASA-TM-X-71892; E-8678) Avail: NTIS HC $3.50 CSCL 13I

The feasibility of an emergency aspirator once-through lubrication system was demonstrated as a viable survivability concept for Army helicopter mainshaft engine bearings for periods as long as 30 minutes. It was also shown in an experimental study using a 46-mm bore bearing test machine that an oil-air mist once-through system with auxiliary air cooling is an effective primary lubrication system at speeds up to 2,500,000 DN for extended operating periods of at least 50 hours. Author

N76-23583*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF TWO PREMIXING-PREVAPORIZING FUEL INJECTION CONCEPTS FOR A GAS TURBINE CATALYTIC COMBUSTOR

Robert Tacina 1976 15 p refs Presented at Catalytic Combustor Workshop, Raleigh, N. C., 25-26 May 1776; sponsored by EPA

(NASA-TM-X-73422; E-8760) Avail: NTIS HC $3.50 CSCL 21E

A premixing-prevaporizing fuel system to be used with a catalytic combustor was evaluated for possible application in an automotive gas turbine. Spatial fuel distribution and degree of vaporization were measured using jet A fuel. Two types of air blast injectors were tested, a splash groove injector and a multiple jet cross stream injector. Air swirlers with vane angles of 15 deg and 30 deg were used to improve the spatial fuel distribution in a 12 cm diameter tubular rig. Distribution and vaporization measurements were made 35.5 cm downstream of the injector. The spatial fuel distribution was nearly uniform with the multiple jet contrastream injector and the splash-groove injector with a 30 deg air swirler. The vaporization was nearly 100 percent at an inlet air temperature of 600 K, and at 800 K inlet air temperature fuel oxidation reactions were observed. The total pressure loss was less than 0.5 percent of the total pressure for the multiple jet cross stream injector and the splash groove injector (without air swirler) and less than 1 percent for the splash groove with a 30 deg air swirler. Author

N76-23584*# IIT Research Inst., Chicago, Ill.

DEVELOPMENT OF SPACE-STABLE THERMAL CONTROL COATINGS FOR USE ON LARGE SPACE VEHICLES Final Report, 4 Jan. 1971 - 1 Nov. 1975

J. E. Gilligan and Y. Harada 15 Mar. 1976 466 p refs

(Contract NAS8-26791; ITTRI Proj. C6233)

(NASA-CR-144310; ITTRI-C6233-57) Avail: NTIS HC $12.00 CSCL 11C

The potential of zinc orthotitanate as a pigment for spacecraft thermal control was demonstrated. The properties and performance of pigments prepared by solid state, coprecipitation, and mixed oxalate methods were compared. Environmental tests and subsequent spectral analysis were given primary emphasis. D.M.L.

N76-23585*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FLEXIBLE PILE THERMAL BARRIER SEAL Patent Application

George E. Anderson (Rockwell Intern. Corp., Downey, Calif.), Donald M. Fell (Rockwell Intern. Corp., Downey, Calif.), and Jerry S. Tesinsky, inventors (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 28 Apr. 1976 16 p Sponsored by NASA

(NASA-Case-MSC-19568-1; US-Patent-Appl-SN-681000) Avail: NTIS HC $3.50 CSCL 11A

A flexible pile thermal barrier insulator including a plurality of upstanding pile yarns is described. A generally planar backing section supports the upstanding pile yarns. The backing section includes a plurality of filler yarns forming a mesh in a first direction. A plurality of warp yarns is looped around filler yarns and pile yarns in the backing section and forms a mesh in a second direction. A binder prevents separation of the yarns in the backing section. NASA

N76-23586# California Univ., Livermore. Lawrence Livermore Lab.

UNIFICATION OF TERMINOLOGY CONCERNING THE ERROR MOTION OF AXES OF ROTATION

J. B. Bryan and P. Vanherck 20 Jun. 1975 34 p refs Presented at the Ann. Conf. of the CIRP, West Germany, 24-30 Aug. 1975 Sponsored by ERDA

(UCRL-76931; Conf-750819-2) Avail: NTIS HC $4.75

Existing terminology for the description of the truth of axes of rotation of spindles is inadequate to meet the current needs of science and industry. An introduction is presented to a new terminology unification document that establishes a coherent language for dealing with this subject. The new document is the result of a cooperative effort of the CIRP Scientific Technical Committee Me and is based on a draft of the American National Standards Institute Committee B89.3.4. Author (ERA)

N76-23587# California Univ., Livermore. Lawrence Livermore Lab.

ADIABATIC SURFACE THERMOMETER FOR IMPROVED PRODUCTION BRAZE QUALITY

G. R. Dittbenner 27 Aug. 1975 13 p refs Presented at the SME/ERDA Welding and Joining Workshop, Chicago Sponsored by ERDA

(UCRL-77295; Conf-751012-8) Avail: NTIS HC $4.00

An adiabatic surface thermometer was developed to control automatically the critical temperature-time cycle of a production vacuum-brazing process. Investigations revealed that optimum braze-joint strength required precise control of the brazing temperature. Spot-welded thermocouples could not be used because the spot welds caused surface damage. This thermometer touches the surface and uses a differntial thermocouple and heater to measure surface temperature without heat flow, thereby eliminating large errors caused by conduction losses common to conventional spring-loaded thermocouples. Temperatures in air or vacuum measured to 800 C with errors less than 5 C. This thermometer has minimized the rejection of production parts, resulting in a cost saving to the U. S. Energy Research and Development Administration. Author (ERA)

N76-23588# Failure Analysis Associates, Stanford, Calif.

AN ENGINEERING FRACTURE MECHANICS ANALYSIS OF THE PILGRIM 1 NOZZLE-TO-PRESSURE VESSEL WELD DISCONTINUITIES

P. M. Besuner Oct. 1975 22 p refs

(PB-247518/4; FAA-75-4-7; EPRI-217-1-TR-6) Avail: NTIS HC $3.50 CSCL 18I

The influence function (IF) method of calculation of stress intensity factor (K sub I)(a) is applied to the case of a semicircular surface crack, of radius a, used to model a discontinuity revealed by in-service inspection of a nozzle to shell weld in Pilgram 1 pressure vessel. The (K sub I) calculations obtained for two complex thermal stress distributions and a combined stress distribution encountered in the nozzle weld, are compared with previous calculations based upon the evaluation of flaw indications method described in the ASME Boiler Pressure vessel Code. It is shown that a substantial difference exists between the (K sub I)(a) values calculated by the code method and the

IF method, except, coincidentally, in the vicinity of the specific flaw size. GRA

N76-23589# United Technologies Research Center, East Hartford, Conn.
EVALUATION OF BASIC LASER WELDING CAPABILITIES Technical Report, Jun. 1974 - Oct. 1975
Edward M. Breinan and Conrad M. Banas Nov. 1975 59 p refs
(Contract N00014-74-C-0423; NR Proj. 031-771)
(AD-A018240; UTRC/R75-911989-4) Avail: NTIS CSCL 13/8

This report contains the results of the first part of a fundamental study of the deep-penetration laser welding process. The study was conducted during the year 1974-1975 with the objective of generating information relevant to the application of laser welding in manufacturing, with particular emphasis on materials of interest to the Navy. The program has concentrated on (1) a study of the influence of laser parameters on welding performance, and (2) a study of the effect of the physical properties of metals on their laser welding response. In the course of study 1, speed/power relationships were determined, along with the effects of laser operating mode and focusing optics on weld penetration and bead shape and cross-sectional area. As a result of study 2, it was determined that within the range where operation could be maintained in the deep-penetration mode, a linear relationship exists on a log-log plot between a dimensionless speed parameter, and a power parameter which is also dimensionless. It was noted that this represents a direct relationship between speed and penetration under conditions of constant power and focusing optics. This correlation can thus be used to select initial deep-penetration laser welding parameters for any metal providing its properties are known. Energy absorption and melting efficiencies were also determined for a range of elemental metals and a new relationship was determined for the limiting melting efficiency. GRA

N76-23590# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
TOOL CONTROL PROGRAM THRU JUNE 1975 Progress Report, Jul. 1969 - Jun. 1975
D. Derion 22 Oct. 1975 43 p
(AD-A018525; NAEC-GSED-93) Avail: NTIS CSCL 13/9

The tool control program is a positive tool accountability system designed to reduce the possibility of hand tools being left adrift in the aircraft following maintenance operations. GRA

N76-23591# Brush Wellman, Inc., Cleveland, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPERFINE FINISH BERYLLIA Quarterly Progress Report, 1 Jul. - 30 Sep. 1975
Glenn H. Rees 10 Oct. 1975 23 p refs
(Contract DAAB07-74-C-0606)
(AD-A018222; BW-TR-573; QPR-5) Avail: NTIS CSCL 09/1

Retesting of 1 MHz, 100 C loss tangent has confirmed the value to be between 6.6 and .000127 which is higher than anticipated. Although data are incomplete, it has been suggested that a peak relationship between loss tangent and frequency exists. The peak position just below 1 MHz shifts higher with increasing temperature. Such a relationship is common for certain other dipolar dielectrics. Author (GRA)

N76-23592# Boeing Commercial Airplane Co., Seattle, Wash.
IMPROVED PNEUMATIC-FLUIDIC ANTISKID SYSTEM AND PRELIMINARY SYSTEM INTEGRATION STUDY Final Report, Sep. 1974 - Jun. 1975
H. H. Straub, R. H. Lichtenwalter, and N. S. Attri Aug. 1975 104 p
(Contract F33615-75-C-3006; AF Proj. 1369)
(AD-A018859; AFFDL-TR-75-80) Avail: NTIS CSCL 13/7

Improvements of an existing pneumatic-fluidic antiskid system leading to operating efficiencies above 85% and installation concepts for a full system test on the T-43A aircraft are described. A fluidic locked wheel and touchdown protection circuit is proposed. Initial design of the integrated fluidic circuit and the modification of the antiskid valve in accordance with a detailed system specification are shown. GRA

N76-23593# Naval Civil Engineering Lab., Port Hueneme, Calif.
HYDRAULIC FLUIDIC LEVEL CONTROL UNIT Final Report, Jul. 1974 - Jun. 1975
E. R. Durlak Dec. 1975 19 p refs
(ZF61512001)
(AD-A018949; CEL-TN-1419) CSCL 13/7

An experimental hydraulic fluidic control unit has been developed that will detect and correct angular variations, such as those experienced by a bulldozer grader blade. The developmental testing was accomplished in two phases. The first phase developed a hybrid electrical/hydraulic system, while the second phase eliminated the electrical interface. The necessary modifications to the equipment were accomplished at CEL. The fluidic control unit requires only an input pressure source, which is normally available from the hydraulic control system of the vehicle. Some additional development work remains on fine tuning the dynamic response of the control unit. GRA

N76-23594# Naval Intelligence Support Center, Washington, D.C. Translation Div.
MECHANIZED NARROW-GAP MIG WELDING OF HEAVY STEEL PLATE
G. A. Belchuk and N. Ya. Titov 2 Dec. 1975 33 p refs Transl. into ENGLISH from the book "Mekhanizirovannaya Svarka po Uzkomu Zazoru Tolstolistovoi Stali Plavyashchimsya Elektrodom v Smesi Zashchitnykh Gazov" Leningrad, 1972 p 3-24
(AD-A019225; NISC-Trans-3731) Avail: NTIS CSCL 13/8

A method is presented for the mechanized narrow-gap MIG welding of heavy plate steel 40-100 mm thick with consumable electrodes of 1.2 to 5 mm diameter. Data are given in regard to evaluation of mechanical properties of the weld metal and the capacity of the welded joint. GRA

N76-23595# Naval Intelligence Support Center, Washington, D.C. Translation Div.
GENERALIZED CHARACTERISTICS OF WATER-JET PUMPS
B. F. Lyamaev 26 Nov. 1975 8 p refs Transl. into ENGLISH from Sudostroenie (USSR), no. 10, 1971 p 29-31
(AD-A019224; NISC-Trans-3717) Avail: NTIS CSCL 13/11

A formula for specific pump discharge is used as the basis of a numerical method for determining the working characteristics of hydraulic jet pumps. D.M.L.

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-23596 National Lending Library for Science and Technology, Boston Spa (England).
NEW PROBLEMS IN STANDARDIZATION AND QUALITY CONTROL IN FERROUS METALLURGY
B. V. Fedin [1975] 13 p Transl. into ENGLISH from Stal (USSR), no. 10, 1975 p 954-957
(NLL-M-25314-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Integrated programs for standardizing control of the quality of industrial production were developed for standardization. The model includes three tracks: (1) parametric (purpose - aims of control, methods of achieving them, and methods of evaluating the extent of their achievement), (2) functional performance of 15 special functions, starting with forecasting demand and planning improvement in quality, and ending with supply of materials, selection of personnel and organization of control), and (3) organizational-labor (regularizing working relationships between man and man, man and machine, and man and the surroundings). Quality is controlled at three hierarchical levels: state (GOST), industry branch or republican (OST), and works (works or works combine standards, STP). Author

N76-23597 Wayne State Univ., Detroit, Mich.
DESIGN RELIABILITY MODELS AND DETERMINATION BY STRESS-STRENGTH INTERFERENCE THEORY Ph.D. Thesis

Sanaa Ismail Roushdy Taraman 1975 192 p
Avail: Univ. Microfilms Order No. 76-11011

The problems of reliability determination and optimization for mechanical and structural components are considered. Reliability models were developed for two situations: (1) single stress application; and (2) repeated stress applications. The reliability of a component which is subjected to a single stress application is determined from the concept that a failure occurs whenever the stress exceeds the strength. Reliability functions were developed for five combinations of stress and strength distributions of the extreme value type. Using numerical methods, tables were generated for the reliability as a function of the parameters of the stress and the strength distributions. The optimization problems of finding the optimal values of the parameters of stress and strength subject to resources and design constraints were developed. For the repeated stress applications case, two stress occurrence models were considered, namely: cyclic stresses and random stresses governed by a Poisson process. Dissert. Abstr.

N76-23598 Pennsylvania State Univ., University Park.
A STRENGTH-STRESS INTERFERENCE MODEL FOR TIME-VARYING PROBABILITY OF FAILURE AND ITS APPLICATION TO AN ELECTROMECHANICAL SYSTEM Ph.D. Thesis
Paul H. Kurtz 1975 219 p
Avail: Univ. Microfilms Order No. 76-10748

A method for predicting the time variation of probability of failure due to cumulative damage and overstress phenomena was investigated. Failure is represented as the event that an applied stress exceeds the corresponding strength of some component. Both the stress and the strength are assumed to be random variables with nonstationary distributions. Failure mechanisms are categorized as being of either the burn-in type, in which probability of failure decreases with time, or of the cumulative damage type, in which probability of failure increases with time. Generalized probabilistic models are derived for predictions of the time variation of the stress and strength distributions for each type of failure mode based on the physical failure mechanisms involved. A digital computer implementation of the models is developed which uses the fast Fourier transform to calculate probability of failure as the convolution of time-varying stress and strength probability density functions. Dissert. Abstr.

N76-23599 British Library Lending Div., Boston Spa (England).
THE EQUIVALENT ENERGY PARAMETER METHOD OF CALCULATING AND FORECASTING THE RELIABILITY OF THE COMPONENT PARTS OF AUTOMATION SYSTEMS AND ELECTRICAL EQUIPMENT
I. S. Auraamov and E. V. Semakin 1975 16 p refs Transl. into ENGLISH from Izvest. Vuz (USSR), v. 4, 1975 p 156-161 (BLL-M-25203-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The energy model of reliability is used as the basis of an equivalent energy parameter method for calculating, analyzing and forecasting time functions for the reliability of the component parts of automation systems and electrical equipment. Author

N76-23600# Sandia Labs., Albuquerque, N.Mex.
CORRELATION BETWEEN BOND RELIABILITY AND SOLID PHASE BONDING TECHNIQUES FOR CONTAMINATED BONDING SURFACES
D. W. Bushmire and P. H. Holloway Sep. 1975 24 p refs (Contract AT(29-1)-789)
(SAND-75-0281) Avail: NTIS HC $4.50

The relationship between bond reliability and the solid phase bonding technique used to interconnect on contaminated substrates was investigated. Hybird microcircuit sunstrates were contaminated with Shipley 1350H photoresist. Solid phase bonds on these HMC substrates were made using six different techniques. The reliability of the bond was determined by destructive testing, recording both the failure strength and failure mode. A bond lift or delamination is indicative of poor reliability in bonds. The order or decreasing sensitivity to contamination (no bond declaminations with increasingly higher contamination levels) for the six different bonding techniques is compliant beam lead, thermocompression fine gold wire, wobble beam lead, thermosonic fine gold wire, thermocompression lead frame, and ultrasonic fine wire aluminum. No degradation of thermocompression fine gold wire or ultrasonic fine wire aluminum bonds on contaminated substrates was observed on accelerated aging treatment of 100 C in air for up to 1,000 h. Author (ERA)

N76-23601# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
BAYES ESTIMATION OF THE RELIABILITY SERIES AND PARALLEL SYSTEMS OF INDEPENDENT EXPONENTIAL COMPONENTS
S. Zacks 15 Dec. 1975 23 p refs
(Contract N00014-75-C-0529; NR Proj. 042-276)
(AD-A018551; TR-22) Avail: NTIS CSCL 14/4

The present paper deals with some problems of estimating the reliability function of integrated systems, by point and confidence interval Bayes estimators. The Bayes point estimators are compared to the classical minimum variance and unbiased estimators in terms of their mean-squared-errors at different combinations of the parameters. The deviation of the exact Bayes confidence limits is discussed. Since it is difficult to determine the exact confidence limits, conservative small sample approximations and the most sufficient large sample normal approximations are derived. The coverage probabilities of the corresponding Bayes confidence intervals and the expected values of these Bayes lower confidence are estimated by simulation experiments. Author (GRA)

N76-23602# Army Material Systems Analysis Activity, Aberdeen Proving Ground, Md.
RELIABILITY GROWTH SYMPOSIUM
Larry H. Crow Sep. 1972 36 p refs Symp. held 26-27 Sep. 1972
(AD-A019372; AMSAA-IN-R-22) Avail: NTIS CSCL 14/4

Contents: Reliability planning and management (RPM); Reliability growth and its upper limit; Estimation procedures for the Duane model; A system debugging model; Reliability growth models; Comparison of some reliability growth estimation and prediction schemes. GRA

N76-23603# Naval Postgraduate School, Monterey, Calif.
APPROXIMATIONS TO THE RELIABILITY OF PHASED MISSIONS Final Report
Harold Ziehms Sep. 1975 33 p refs
(AD-A018853; NPS-55Ey75091) Avail: NTIS CSCL 14/4

A system whose configuration (block diagram or fault tree) changes during consecutive time periods (phases) performs a 'phased mission.' Recently, Esary and Ziehms have shown that any multi-phase mission can be transformed into an equivalent, synthetic, single-phase system, and thus that the phased mission problem can in principle be solved by standard reliability methods. The author employs these ideas here to study approximations to mission reliability and to develop an algorithm which may be of practical interest. In addition, he extends the reliability calculus of Rubinstein, and Esary and Hayne, based on an approximate hazard transform, to phased missions. It is shown how this extended calculus can be used in situations where phases are not of known fixed duration. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-23604 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 7, NO. 3
Mar. 1975 101 p refs
(AD-A006787) Avail: SVIC, Code 8404, Naval Research Laboratory, Washington, D. C. 20375

Four papers dealing with shock and/or vibration were presented: (1) systems performance effectiveness as related to shock and vibration environments, (2) survey of the dynamic

response of spherical and spheroidal shells, (3) survey of theoretical and experimental mechanics applied to head injury, (4) approximate theories governing axisymmetric wave propagation in elastic rods. Other information given included: news briefs, previews and reviews of meetings, listing of short courses, abstracts from the current literature, book reviews. For individual titles, see N76-23605 through N76-23608.

N76-23605 Naval Research Lab., Washington, D.C. Ocean Technology Div.
SYSTEMS PERFORMANCE EFFECTIVENESS AS RELATED TO SHOCK AND VIBRATION ENVIRONMENTS
H. M. Forkois *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Dig., Vol. 7, No. 3, 1975 Mar. 1975 p 2-3 refs (For availability see N76-23604 14-39)

The following problem areas requiring attention in the area of shock and vibration environments were discussed: (1) research, (2) technology, (3) equipment design, (4) reliability prediction, (5) shock and vibration environment assessment, (6) specifications, (7) equipment testing, (8) documentation, and (9) parts suitability. It was pointed out that one of the basic causes for these recurring problems is contractor and government personnel turnover and attrition rates which preclude a satisfactory continuity of experience as new project groups are formed in response to new contract acquisitions. Y.J.A.

N76-23606 Ohio State Univ., Columbus.
SURVEY OF THE DYNAMIC RESPONSE OF SPHERICAL AND SPHEROIDAL SHELLS
Ali E. Engin and Ann W. Engin *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Dig., Vol. 7, No. 3, 1975 Mar. 1975 p 65-78 refs (For availability see N76-23604 14-39)

A survey of the dynamic response of spherical and spheroidal shells was presented. Since these shells are special cases of shells of revolution, some references on the latter are also mentioned. The article has two major sections; namely, a section dealing with the dynamic response analyses of shells in vacuo (here in vacuo means ambient atmospheric conditions) and a section dealing with studies involving shells in contact externally and/or internally with fluids. In each section references are mentioned according to such categories as type of shell (shallow or complete); type of vibration (free or forced); type of loading (transient or blast); and type of shell material (isotropic, orthotropic and aeolotropic). Author

N76-23607 Ohio State Univ., Columbus.
SURVEY OF THEORETICAL AND EXPERIMENTAL MECHANICS APPLIED TO HEAD INJURY **c52**
Ali E. Engin and Ann W. Engin *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Dig., Vol. 7, No. 3, 1975 Mar. 1975 p 78-90 refs (For availability see N76-23604 14-39)

Some of the theoretical and experimental mechanics investigations applied to the head injury problem were presented. The treatment was divided into the following sections: (1) studies dealing directly with analytical modelling of head impact, (2) theoretical and experimental studies on determination of mechanical properties of the constituents of the head, (3) experimental studies conducted on skulls of cadavers, live and dead animals and artificial models. Author

N76-23608 California Univ., Berkeley.
APPROXIMATE THEORIES GOVERNING AXISYMMETRIC WAVE PROPAGATION IN ELASTIC RODS
H. D. McNiven *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Dig., Vol. 7, No. 3, 1975 Mar. 1975 p 90-96 refs (For availability see N76-23604 14-39)

An historical accounting of the major approximate theories concerned with wave propagation in rods was presented with the objective of gaining an insight so that other approximate theories could be developed. The exact theory of Pochammer was used as a starting point. It is shown that spectral lines from the lowest branches of the exact theory, when compared with comparable branches from an approximate theory, give a very accurate appraisal of the approximate theory and the extent of frequency-wavelength domain to which its use should be restricted. Author

N76-23609 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STRESS INTENSITIES FOR LOW ASPECT RATIO SURFACE FLAWS IN PRESSURIZED THICK WALLED TUBES Ph.D. Thesis
Tianlai Hu 1975 134 p
Avail: Univ. Microfilms Order No. 76-11266

A series of stress freezing photoelastic experiments were conducted on thick walled cylinders containing longitudinal low aspect ratio surface flaws under internal pressure. Slices normal to the cylinder axis near the flaw midpoint were analyzed photoelastically and the stress intensity factor was estimated from a technique involving a computer-assisted least squares analysis of the photoelastic data. Results were compared with the Bowie-Freese solution to the plane problem, which is viewed as an upper bound to the problem, the Underwood Approximation, and an approximation theory due to F. W. Smith. Results were also discussed over those obtained from plate tests with identical crack shapes. Dissert. Abstr.

N76-23610 British Library Lending Div., Boston Spa (England).
SOME APPLICATIONS OF THE ELASTICITY MODULUS IN MATERIALS TESTING
M. D. Eason, J. R. Lakin, and G. Payne [1975] 6 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (West Ger.), vol. 43, Sep. 1966 p 443-446
(BLL-NCB-A2970/JG(9022.66)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Two examples are given of the application of dynamic modulus of elasticity tests to the assessment of materials. The behavior of graphite electrodes in large arc furnaces are shown to be related to their mechanical properties and elasticity modulus determinations form the basis of a nondestructive control test. Modulus of elasticity was also used to follow the progress of damage due to thermal fluctuations. Castable refractories were also studied, and a continuous measurement of modulus of elasticity during heating provides information on the dehydration of the cement. Author

N76-23611 British Library Lending Div., Boston Spa (England).
THE EFFECT OF SECONDARY BENDING ON THE FATIGUE STRENGTH OF JOINTS
D. Schutz and H. Lowak Aug. 1975 74 p refs Transl. into ENGLISH from Lab. Betriebsfestigkeit (West Germany), 1974 Rept. FB-113
(BLL-RAE-Lib-Trans-1858-(5207); Rept-FB-13) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Strain measurements on complete structures and structural sections were carried out with the help of bending-strain gauges, in order to obtain information concerning the magnitude of secondary bending loads encountered on typical constructional elements of aircraft structures. An analytical method for the determination of the secondary bending load is presented and its validity investigated. For future fatigue strength tests with single-shear joints, the results of which are to be used in a preliminary design process, a realistic value of the ratio of the secondary bending stress to the axial stress is proposed and a way is indicated by which the accuracy of the life prediction of single-shear joints can be increased. Author

N76-23612 British Library Lending Div., Boston Spa (England).
CONSTRUCTION PROBLEMS OF CERAMIC-METAL JOINTS
R. Gutowski, W. Maslankiewicz, and J. Milosz Jan. 1976 15 p refs Transl. into ENGLISH from Szklo Ceram. (Warsaw), v. 23, no. 1, 1972 p 21-25
(BLL-RTS-9982) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 8 BLL photocopy coupons

A theoretical method is reported for the determination of optimum dimensions of a ceramic-metal joint system under given initial conditions. The results of calculations on concrete materials, presented in the form of diagrams, serve during the design of ceramic-metal joint systems, primarily as regards the rapid assessment of the changes in the stresses as function of the individual parameters of the joint. Author

N76-23613 Arizona Univ., Tucson.
FINITE-DIFFERENCE ANALYSIS OF ANISOTROPIC BODIES Ph.D. Thesis

Earl Thomas Pearson 1975 189 p
Avail: Univ. Microfilms Order No. 76-11331

A numerical (computer oriented) finite-difference method of determining dynamic and equilibrium stress-displacement-velocity solutions is described for anisotropic bodies with a wide range of initial and boundary conditions. If the elastic properties of a material vary with orientation, the material is called anisotropic. Stresses and deflections of anisotropic bodies are influenced by the orientation and magnitudes of the material properties. The governing equations are written in general tensor form for infinitesimal displacements. It is assumed that the material is of uniform density. Materials that are not strictly of uniform density (plywood, reinforced concrete, composites, etc.) can be considered whenever bulk properties can be assigned to the material. Body forces and nonuniform temperature distributions are included in the relations. Only dynamic conditions (vibration, wave propagation) within the concept of infinitesimal displacements are considered. Dissert. Abstr.

N76-23614 Oklahoma State Univ., Stillwater.
DYNAMIC RESPONSE OF NONCIRCULAR STIFFENED CYLINDRICAL SHELLS WITH RECTANGULAR CUTOUTS Ph.D. Thesis
Mahabaliraja 1974 138 p
Avail: Univ. Microfilms Order No. 76-9717

This method is based on the Rayleigh-Ritz technique using beam characteristic (axially) and trigonometric (circumferentially) functions in the displacement series. Studies are made to determine the effect on the frequencies and modes of: (1) cutout size and (2) cutout location. A study is made of the effect of the cutout on the displacement and stress responses of an unstiffened shell subjected to an air-blast type of transient load. In general, the cutout has a reducing effect on the frequencies. The largest effect is on the fundamental frequency. For large cutouts the mode shapes display a strong coupling of distinct wave forms. The location of the cutout has only a small influence on the frequencies. Introduction of the cutout causes increased participation of higher modes and flexure in the transient response of the shell. The method of analysis is found to be inadequate to predict the stress behavior very close to the cutout in the narrow region where thin shell theory is known to be invalid. Dissert. Abstr.

N76-23615 Wisconsin Univ., Madison.
DYNAMIC RESPONSE ANALYSIS OF TALL BUILDINGS SUBJECTED TO WIND AS A MULTIDIMENSIONAL AND MULTIVARIATE STOCHASTIC PROCESS Ph.D. Thesis
Paramasivam Jayachandran 1975 568 p
Avail: Univ. Microfilms Order No. 76-2486

The current trends in the design of tall buildings result in lighter and less damped structures which are more sensitive to the dynamic fluctuating forces caused by turbulence in the wind. Hence, a realistic mathematical model of wind and structure is essential in the dynamic response analysis of tall buildings for strength, serviceability and human comfort. The statistics of wind forces and response yield useful information on the cross-correlation of forces and response parameters at several levels of the structure and enable the definition of probability laws of exciting forces and response. The frequency spectrum of the simulated wind compares very well with the measured wind spectra available for different terrain conditions. The quality and performance of the wind model, the multiple degree of freedom dynamic model of the structure, the damping function, and the method of calculation of response are examined for efficiency and ease of computation. Dissert. Abstr.

N76-23616 Ohio State Univ., Columbus.
A STUDY OF FATIGUE MODELS FOR ASPHALT CONCRETE PAVEMENTS UNDER VARIABLE TEMPERATURE CONDITIONS Ph.D. Thesis
Faiz Makdisi-Ilyas 1975 197 p
Avail: Univ. Microfilms Order No. 76-10003

Using fracture mechanics concepts, a number of fatigue models for asphaltic concrete were investigated in this dissertation. These models ranged from the simplest form to the most general form. The variation of the parameters in these models was studied and relations to the properties of the asphaltic mix were investigated. The laboratory mix investigated essentially confirmed to the Ohio Department of Transportation specification item 402 asphalt concrete. In addition to fatigue testing, other tests were conducted to obtain the mechanical response of the mix. Because asphalt mixes display a delayed response due to loading, six test temperatures were used to study the viscoelastic response of the mixture. The time-temperature superposition principle was used to reduce the crack propagation data for the different temperatures. The shift function for the fatigue data was related to that of the creep compliance. Furthermore, relations between the fatigue models' parameters and the temperature shift function were deduced. Checking the models, verification of the results and extension to other asphalt mixtures were discussed. Some examples of applications to actual pavements were illustrated. The results of these examples were reasonable compared to actual situation. Dissert. Abstr.

N76-23617 West Virginia Univ., Morgantown.
A STUDY OF THE INFLUENCE OF SPANDREL BEAMS ON THE BEHAVIOR OF REINFORCED CONCRETE SLABS Ph.D. Thesis
Mukund Martand Moharir 1975 212 p
Avail: Univ. Microfilms Order No. 76-11775

A method to design reinforced concrete floor slabs which terminate at edge beams is presented. The design procedure uses the Modified Yield Line Theory of Kemp and Wilhelm to account for the influence of torsional stiffness of edge beams on the load carrying capacity of slab and also to provide the economic reinforcement. Serviceability requirement of the structure is satisfied by using the exact elastic solution and the experimental and theoretical work of this investigation. The necessary theoretical derivations of the exact elastic solution of square panels, design formulas to proportion the spandrels of both rectangular and square panels, ultimate equilibrium equation of the Modified Yield Line Theory, formulas for factor of safety against flexural cracking and combined effect of torsion and shear interaction on edge beams, etc., are first time successfully worked out and incorporated. Dissert. Abstr.

N76-23618 Arizona Univ., Tucson.
ANALYSIS OF LARGE DEFLECTIONS AND STABILITY OF TIED CIRCULAR ARCHES Ph.D. Thesis
Mufid Fawzi Samara 1975 80 p
Avail: Univ. Microfilms Order No. 76-11314

Two types of tied pinned inextensional circular arches are treated: the type 1 arch is pinned at one end with a roller on the other end, and a linearly elastic tie connects the two points of support. The type 2 arch is pinned at both supports with a linearly elastic tie at points intermediate between the supports and the crown. A general governing equation is derived, based on curved beam theory. Winkler-Bach assumptions and Hooke's law are assumed to apply. No restriction is placed on the magnitudes of the deflections or the rotations of the arch elements. The condition of inextensibility is later applied to the governing equation. The resulting governing differential equation is applied separately to the two types of arch, leading to two sets of governing nonlinear differential equations. These sets of equations are reformulated into rate equations of equilibrium. The rate equations are found to be linear in the rates, and are integrated and used in the classic sense to determine instantaneous stiffness coefficients. Dissert. Abstr.

N76-23619 Oregon State Univ., Corvallis.
FINITE ELEMENT ANALYSIS OF CIRCULAR CELL BULKHEADS Ph.D. Thesis
Likhit Kittisatra 1976 195 p
Avail: Univ. Microfilms Order No. 76-9850

A mathematical model is developed for the analysis of circular cell bulkheads subjected to gravity loads of cell fill, backfill, lateral pressure, and surcharge load using the finite element method. The finite element circular cell model consists of axisymmetric triangular and/or quadrilateral ring elements for soil and cylindrical shell elements for the steel cell. To formulate and derive the governing equations for such elements, the Ritz displacement functions and the theorem of minimum potential energy are used. The loadings of the bulkhead system and corresponding displacements are expanded in Fourier series. The soil fill and foundation are assumed to be elastic, isotropic and nonhomogeneous materials. It is assumed that there is no slippage

in the soil-steel shell interface. The circular cell bulkhead is analyzed for stresses in the soil elements and shell elements and deformations for the isolated filled cell and backfilled cell cases. Dissert. Abstr.

N76-23620 National Lending Library for Science and Technology, Boston Spa (England).
FLOW CRITERION AND STRESS-STRAIN RELATIONSHIP FOR GROOVED TENSILE SPECIMENS
Josef Ziebs, Hans Dieter Kuhn, and Siegmar Ledworuski 1975 26 p refs Transl. into ENGLISH from Z. Metallk. (Berlin), vol. 66, no. 1, 1975 p 58-66
(NLL-M-24068-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

It must be stated that only for orthotropic materials, where the principal axis-system of the stress-strain conditions match permanently in location with those of the deformation rates, where there are no shear strains, do experiment and theory satisfactorily correspond. It is added also that the determination of the flow boundary can only be a short-cut, since a complete evaluation of the balanced flow ellipse is impossible. Author

N76-23621 Mississippi State Univ., State College.
AN EXPERIMENTAL STUDY OF THE TIME DEPENDENT FORCES OF DISKS IN LARGE AMPLITUDE HARMONIC MOTION Ph.D. Thesis
Paul Myron Jeglum 1975 169 p
Avail: Univ. Microfilms Order No. 76-11796

The aerodynamic forces on disks of various sizes and shapes undergoing large amplitude harmonic motion in quiescent air have been measured by direct strain gage balance measurement techniques, and the flow phenomena observed by a flow visualization. The measurement of these forces, with air as the fluid medium, was dependent on the quality of the force measurement devices, the actual motion of the disks, and the signal conditioning and data acquisition equipment. Dissert. Abstr.

N76-23622 California Inst. of Tech., Pasadena.
THE STEADY STATE RESPONSE OF MULTIDEGREE-OF-FREEDOM SYSTEMS WITH A SPATIALLY LOCALIZED NONLINEARITY Ph.D. Thesis
Richard Keith Miller 1976 202 p
Avail: Univ. Microfilms Order No. 76-10441

The dynamic response of a general multidegree-of-freedom linear system with a one dimensional nonlinear constraint attached between two points was studied. The nonlinear constraint is assumed to consist of rate-independent conservative and hysteretic nonlinearities and may contain a viscous dissipation element. The dynamic equations for general spatial and temporal load distributions are derived for both continuous and discrete systems. The method of equivalent linearization is used to develop equations which govern the approximate steady-state response to generally distributed loads with harmonic time dependence. The qualitative response behavior of a class of undamped chainlike structures with a nonlinear terminal constraint is investigated. It is shown that the hardening or softening behavior of every resonance curve is similar and is determined by the properties of the constraint. Dissert. Abstr.

N76-23623*# Martin Marietta Corp., Denver, Colo.
SHUTTLE ON-PAD GROUND WIND LOADS Final Report, Sep. 1974 - Mar. 1976
A. D. Devers, E. Simon, T. E. Blejwas, and A. C. Park Apr. 1976 285 p refs
(Contract NAS8-31164)
(NASA-CR-144290; MCR-75-446) Avail: NTIS HC $9.25 CSCL 13M

A digital computer program system capability was developed which includes: (1) the ability to generate both static and dynamic load components and resultants for all wind azimuths due to drag, gusts and/or wind induced oscillations; (2) the ability to establish both static and dynamic components and resultant deflections versus vehicle station for the separate shuttle system components; (3) the ability to analyze the dynamic loads and responses resulting from Orbiter ignition/shutdown (rebound phenomena); and (4) the ability to combine structural loads and deflections from different load sources. Author

N76-23624*# Colorado Univ., Boulder. College of Engineering and Applied Science.
COUPLED BASE MOTION RESPONSE ANALYSIS OF PAYLOAD STRUCTURAL SYSTEMS Final Report
A. Darrell Devers, Harry Harcrow, and Anant R. Kukreti Apr. 1976 113 p refs
(Contract NAS8-31619)
(NASA-CR-144291; UCCE-75-2) Avail: NTIS HC $5.50 CSCL 13M

Coupled base motion response analysis of payload structural systems is discussed. A systems analysis program is described which by component analysis structural transient response analyses can be completed. The program presents a proven technique, used initially on the Skylab program, which is designed to reduce cost and schedule time on detail structural analyses of structural payload systems. Base motion procedures are employed where critical segments of complex structural systems or components may be analyzed for various load conditions without having to re-establish the entire structural system coupled model properties. The transient response characteristics of a complex structural system are used as a basis for evaluating the transient response of a similar system. Author

N76-23625*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTO-MECHANICAL SUBSYSTEM WITH TEMPERATURE COMPENSATION THROUGH ISOTHERMAL DESIGN Patent Application
Francis E. Goodwin, inventor (to NASA) (Hughes Aircraft Co., Los Angeles) Filed 28 Apr. 1976 16 p
(Contract NAS5-21859)
(NASA-Case-GSC-12059-1; US-Patent-Appl-SN-680957) Avail: NTIS HC $3.50 CSCL 13M

An opto-mechanical subsystem for supporting a laser structure which minimizes changes in the alignment of the laser optics in response to temperature variations is described. Both optical and mechanical structural components of the system are formed of the same material, preferably beryllium, which is selected for high mechanical strength and good thermal conducting qualities. All mechanical and optical components are mounted and assembled to provide thorough thermal coupling throughout the subsystem to prevent the development of temperature gradients. NASA

N76-23626*# Boeing Commercial Airplane Co., Seattle, Wash.
ACCELERATION OF FATIGUE TESTS FOR BUILT-UP TITANIUM COMPONENTS Final Report
R. T. Watanabe Washington NASA May 1976 55 p refs
(Contract NAS1-12501)
(NASA-CR-2658; D6-42768) Avail: NTIS HC $4.50 CSCL 14D

A study was made of the feasibility of a room-temperature scheme of accelerating fatigue tests for Mach 3 advanced supersonic transport aircraft. The test scheme used equivalent room-temperature cycles calculated for supersonic flight conditions. Verification tests were conducted using specimens representing titanium wing lower surface structure. Test-acceleration parameters were developed for the test with an auxiliary test set. Five specimens were tested with a flight-by-flight load and temperature spectrum to simulate typical Mach 3 operation. Two additional sets of five specimens were tested at room temperature to evaluate the test-acceleration scheme. The fatigue behavior of the specimens generally correlated well with the proposed correction method. Author

N76-23627*# Grumman Aerospace Corp., Bethpage, N.Y.
A NUMERICALLY EFFICIENT FINITE ELEMENT HYDROELASTIC ANALYSIS. VOLUME 1: THEORY AND RESULTS Final Report
Robert N. Coppolino Washington NASA Apr. 1976 103 p refs
(Contract NAS1-10635)
(NASA-CR-2662) Avail: NTIS HC $5.50 CSCL 13M

Symmetric finite element matrix formulations for compressible and incompressible hydroelasticity are developed on the basis of Toupin's complementary formulation of classical mechanics. Results of implementation of the new technique in the NASTRAN

structural analysis program are presented which demonstrate accuracy and efficiency. Author

N76-23628# Naval Civil Engineering Lab., Port Hueneme, Calif.
SHRINKAGE-COMPENSATING CEMENT FOR AIRPORT PAVEMENTS, PHASE 1 Interim Report, Jan. - May 1975
John R. Keeton Jun. 1975 19 p refs
(Contract DOT-FA75WAI-530)
(AD-A022061/6; FAA-RD-75-89) Avail: NTIS HC $3.50 CSCL 13/3

A history of the development of expansive cements and a summary of field use of expansive concretes pertinent to airport pavements are presented. A comprehensive research program is proposed for developing experimental data on expansive cement concretes which are needed to form a basis for designs of airport pavements that will provide longer joint spacings. The proposed research includes specimen sizes, instrumentation, reinforcing, curing, shrinkage environments, concrete mix design, aggregates, and cements to be used. Author

N76-23629*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATION CHARACTERISTICS OF 1/8-SCALE DYNAMIC MODELS OF THE SPACE-SHUTTLE SOLID-ROCKET BOOSTERS
Sumner A. Leadbetter, Wendell Stephens, John L. Sewall, Joe W. Majka, and Jack R. Barret (Rockwell Intern.) Washington May 1976 56 p refs Presented at the 46th Shock and Vibration Symp., San Diego, Calif., 21-23 Oct. 1975
(NASA-TN-D-8158; L-10524) Avail: NTIS HC $4.50 CSCL 13M

Vibration tests and analyses of six 1/8 scale models of the space shuttle solid rocket boosters are reported. Natural vibration frequencies and mode shapes were obtained for these aluminum shell models having internal solid fuel configurations corresponding to launch, midburn (maximum dynamic pressure), and near endburn (burnout) flight conditions. Test results for longitudinal, torsional, bending, and shell vibration frequencies are compared with analytical predictions derived from thin shell theory and from finite element plate and beam theory. The lowest analytical longitudinal, torsional, bending, and shell vibration frequencies were within + or - 10 percent of experimental values. The effects of damping and asymmetric end skirts on natural vibration frequency were also considered. The analytical frequencies of an idealized full scale space shuttle solid rocket boosted structure are computed with and without internal pressure and are compared with the 1/8 scale model results. Author

N76-23630# Oak Ridge National Lab., Tenn.
THEORETICAL AND EXPERIMENTAL STRESS ANALYSES OF ORNL THIN-SHELL CYLINDER-TO-CYLINDER MODEL 4
R. C. Gwaltney, S. E. Bolt, and J. W. Bryson Jun. 1975 181 p refs
(Contract W-7405-eng-26)
(ORNL-5019) Avail: NTIS HC $7.60

The last in a series of four thin shell cylinder-to-cylinder models was tested, and the experimentally determined elastic stress distributions were compared with theoretical predictions obtained from a thin shell finite element analysis. The models in the series are idealized thin shell structures consisting of two circular cylindrical shells that intersect at right angles. There are no transitions, reinforcements, or fillets in the junction region. This series of model tests serves two basic purposes: (1) the experimental data provide design information directly applicable to nozzles in cylindrical vessels, and (2) the idealized models provide test results for use in developing and evaluating theoretical analyses applicable to nozzles in cylindrical vessels and to thin piping tees. Author (ERA)

N76-23631# Sandia Labs., Albuquerque, N.Mex.
PROGRESSIVE FRACTURE MODEL FOR BRITTLE MATERIALS
P. Yarrington Sep. 1975 23 p refs
(Contract AT(29-1)-789)
(SAND-75-0328) Avail: NTIS HC $4.00

Presented is a model of progressive fracture for brittle materials subjected to plane impulsive loading. The model is based largely on the two dimensional Griffith theory of brittle fracture. Calculational results are presented for progressive fracture in an annulus of material subjected to an impulsive internal pressurization. The loading conditions and the geometry used in these calculations are similar to those that would be used to model a borehole explosion problem. Author (ERA)

N76-23632# Oak Ridge Y-12 Plant, Tenn.
SYSTEM FOR EVALUATING THE DEFORMATION OF VARIOUS MATERIALS UNDER COMPRESSIVE LOADS
R. A. Gallman Nov. 1975 14 p refs
(Contract W-7405-eng-26)
(Y-2002) Avail: NTIS HC $4.00

A test system was developed in two versions which can determine the deformation of various materials under selectable, uniaxial, compressive loads. The field model is an inexpensive, rugged, easily operated instrument intended for production use; whereas, the instrumented model is an accurate instrument, with analog and digital outputs, intended for use as a certification tool. Author (ERA)

N76-23633# Weiler Research, Inc., Mountain View, Calif.
DOASIS: A COMPUTER CODE FOR THE DEFORMATION PLASTIC, ORTHOTROPIC, AXISYMMETRIC AND PLANE SOLUTION OF INELASTIC SOLIDS. VOLUME 1. FINITE ELEMENT PROGRAM. THEORETICAL AND PROGRAMMERS MANUAL Final Report, Jun. 1974 - Oct. 1975
Frank C. Weiler Oct. 1975 313 p refs
(Contract F33615-74-C-0148)
(AD-A018634; AFML-TR-75-37-Vol-1) Avail: NTIS CSCL 20/11

The finite element (displacement) method is used to determine the displacements, (elastic, plastic, thermal) strains, stresses; effective strains and stress in axisymmetric, constant thickness and variable thickness plane solids, with different orthotropic, elastic-plastic, temperature dependent material properties in tension and compression including the effect of either initial strains or stresses. The mechanical loads can be surface normal or tangential pressures, concentrated point or line nodal point loads, interference fit displacement conditions or body force loads (acceleration or angular velocity). The continuous solid is replaced by a system of discrete finite elements having either triangular or quadrilateral cross sections. The solution of the continuous solid is reduced to the solution of a set of linear, algebraic simultaneous equations yielding the displacements, from which the strains and stresses are determined. The nodal point forces are calculated at nodal points where displacements are specified. Residual errors and force equilibrium are checked. The DOASIS computer program is described and sample problems are presented, and illustrating its use. GRA

N76-23634# Naval Intelligence Support Center, Washington, D.C. Translation Div.
EFFECT OF SHAPE OF EXTERNAL PRESSURE IMPULSE AND DESIGN PARAMETERS OF THIN CIRCULAR CYLINDRICAL SHELLS ON THEIR STABILITY
E. I. Grigolyuk and A. I. Srebovskii 1 Dec. 1975 8 p refs Transl. into ENGLISH from Vliyaniye Formy Impulsa Vneshnego Davleniya i Konstruktivnykh Parametrov Tonkikh Krugovykh Tsilindricheskikh Obolochek na ikh Ustoychivost; Izv. Vyssh. Ucheb. Zaved. (USSR), no. 4, 1971 p 28-31
(AD-A019228; NISC-Trans-3729) Avail: NTIS CSCL 20/11

The report studies the effect of the shape of an impulse of uniform external pressure of sufficient magnitude to cause a bend on the order of shell thickness in thin closed cylindrical shells. As a consequence of inertia in a shell during dynamic loading, the rate of application of the load will be greater than the rate of buildup of deflections. Therefore, the loss of stability takes place at a higher energy level and this leads to possible changes in the shape of wave formation. In order to account for this phenomenon, a shell at a certain level of stability is viewed as an elastic system with k degrees of freedom and the process of wave formation in it assumes a shape which is most favorable for a given load. GRA

N76-23635# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
TWO DIMENSIONAL STRESS INTENSITY FACTOR SOLU-

TIONS FOR RADIALLY CRACKED RINGS Final Report, Mar.-Dec. 1974
Alten F. Grandt, Jr. Oct. 1975 31 p refs
(AF Proj. 7351)
(AD-A018670; AFML-TR-75-121) Avail: NTIS CSCL 20/11

A weight function technique is used to obtain mode I stress intensity factor solutions for radially cracked rings loaded with arbitrary crack face pressure. When the crack face pressure is defined as the hoop stress occurring in an unflawed member subjected to complex loading, stress intensity factor calibrations may be obtained by the linear superposition method. This procedure is demonstrated with calculations for rings loaded in compression, for cylinders under internal and external pressure, and for centrifugal stresses induced by rotating the rings. Solutions obtained in this manner agree well with previous results found by other methods. It is suggested that the solution and techniques described here may have further application to other practical problems. Author (GRA)

N76-23636# Weidlinger Associates, New York.
DYNAMIC RESPONSE OF A CYLINDRICAL CAVITY OF FINITE LENGTH IN A BILINEAR MATERIAL Interim Report
A. T. Matthews and H. H. Bleich Jun. 1975 32 p refs
(Contract DASA01-71-C-0098; DNA Proj. NWED-QAXSC061)
(AD-A018644; DNA-3756T) Avail: NTIS CSCL 19/4

The response of a cylindrical cavity of finite length in a bilinear (hysteretic), layered, material is obtained for a pressure pulse, p(tau), applied to the inner boundary of the cavity. The problem is two-dimensional in r, z coordinates, the loading being axisymmetric. The solution is obtained from a characteristic approach combined with the method of fractional steps. Results are presented for a non-layered configuration, and also for a case in which three layers are present. Comparisons of these solutions with results from a finite difference code using the same two-dimensional configurations are given. Further development will allow for the presence of a structure lining the cavity in a bilinear material. GRA

N76-23311* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPOSED MODIFICATIONS TO THE WIND LOADING SPECIFICATIONS APPLIED TO GROUND ANTENNAS
M. S. Katow *In its* The Deep Space Network 15 Apr. 1976 p 65-69 refs (For availability see N76-23304 14-12)
CSCL 13M

N76-23314* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FOUNDATION ANALYSIS, PRELIMINARY INVESTIGATION
H. McGinness and M. S. Katow *In its* The Deep Space Network 15 Apr. 1976 p 81-85 ref (For availability see N76-23304 14-12)
CSCL 13M

N76-23318* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WAVEFRONT STIFFNESS MATRIX RESEQUENCING PROGRAM MODIFICATIONS FOR THE 1108 COMPUTER
R. Levy *In its* The Deep Space Network 15 Apr. 1976 p 106-109 refs (For availability see N76-23304 14-12)
CSCL 13M

42 GEOSCIENCES (GENERAL)

N76-23637# Oak Ridge National Lab., Tenn.
LAND USE SUITABILITY SCREENING FOR POWER PLANT SITES IN MARYLAND
J. E. Dobson 1975 19 p refs Presented at the 30th Ann. Meeting of the Southeastern Div. of the Assoc. of Am. Geographers, Pine Mountain, Ga., 23-25 Nov. 1975 Sponsored by ERDA
(CONF-751122-1) Avail: NTIS HC $4.50

Since 1974 Oak Ridge National Laboratory (ORNL) has been engaged in developing an automated procedure for land use suitability screening. The Nuclear Regulatory Commission has funded the project to aid in the selection of power plant sites in Maryland. Its purpose is to identify candidate areas from which specific candidate sites can be chosen for detailed analyses. The ORNL approach assures that certain key variables are examined empirically for every cell in the study region before candidate sites are selected. Each variable is assigned an importance weight and compatibility score based upon its effect on the economic, social, or ecologic costs associated with construction in a given cell. The weighted scores for each variable are aggregated and output as a suitability score for each cell. Author (NSA)

N76-23638# California Univ., Berkeley. Lawrence Berkeley Lab.
PROGRAM OF GEOSCIENCE RESEARCH
Feb. 1975 45 p Sponsored by ERDA
(UCID-3711) Avail: NTIS HC $5.00

An overview is presented of the accomplishments, present status, and plans of geoscience research to examine the physical and chemical behavior of geologic systems and their modification through engineering works. The structure of the LBL Program of research is as follows: Geologic Materials -- rocks and minerals, brines, and rock-fluid systems; Geothermal Resources -- igneous centers, regional geophysics, reservoir delineation, radioactivity, chemical composition, and reservoir dynamics; Fossil Energy Resources -- petroleum recovery, thermal extraction, and coal particulates; Mechanics of Earth Systems -- soils and soft rocks, gravity, offshore platforms, and fractured rock masses; Seismic Hazards -- soil-structure interactions and earthquake prediction. ERA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-23639 Virginia Polytechnic Inst. and State Univ., Blacksburg.
REMOTE SENSING APPLICATION TO LAND USE CLASSIFICATION IN A RAPIDLY CHANGING AGRICULTURAL/URBAN AREA-CITY OF VIRGINIA BEACH, VIRGINIA Ph.D. Thesis
Victor Agab Ohondi Odenyo 1976 174 p
Avail: Univ. Microfilms Order No. 76-11120

Remote sensing data on computer-compatible tapes of LANDSAT-1 MSS frame E-1483-15132 of August 30, 1973, were analyzed to generate a land use map of the City of Virginia Beach. Color IR imagery of U-2 flight 73-185, November 1, 1973, of the same area was also digitized and two sample areas were analyzed via the unsupervised approach. The I2S Additive Color Combiner was also utilized with LANDSAT-1 imagery. The relationships between the mapped land use and the soils of the area were investigated. A Land Use/Land Cover map at a scale of 1:24,000 was obtained from the supervised analysis of LANDSAT-1 data. Dissert. Abstr.

N76-23640 Oregon State Univ., Corvallis.
DIGITAL TECHNIQUES FOR CHANGE DETECTION FROM REMOTELY SENSED DATA (LANDSAT-IMAGERY) Ph.D. Thesis
Hassan Eghbali 1976 162 p
Avail. Univ. Microfilms Order No. 76-9846

Digital techniques for detecting changes between two LANDSAT images were developed. A data matrix containing 16x16 picture elements was used used for this purpose. The LANDSAT-Imagery data were corrected for sensor inconsistencies and varying sun illumination. The Kolmogorov-Smirnov test (K-S test) was performed between the two corrected data matrices. This test is based on the absolute value of the maximum difference D(max) between the two cumulative frequency distributions. The limiting distribution of D(max) is known; thus a statistical decision concerning changes can be evaluated for the region. The K-S test was applied to all bands of imagery (four through seven). The test was applied to four test sites. It successfully isolated regions of change in snow cover, forest cover (clear cut), and urban regions (Salem, Oregon). The test was found to be relatively

independent of slight misregistration. A feature vector developed from the two dimensional Fourier and Hadamard transform was also shown to be sensitive for detecting changes. This vector shows promise for classifying large data blocks. Forest, urban, and snow regions were successfully classified. Dissert. Abstr.

N76-23641*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SKYLAB-4 RADAR SCATTEROMETER MEASUREMENTS OVER LAND Final Report, 26 Mar. 1973 - 31 Dec. 1975
Richard K. Moore, Principal Investigator Feb. 1976 38 p refs EREP
(Contract NAS9-13331)
(E76-10307; NASA-CR-147569; RSL-TR-243-13) Avail: NTIS HC $4.00 CSCL 17E

The author has identified the following significant results. Analysis of the SL4 S193 scatterometer observations shows that the winter measurements were reasonably consistent with summer measurements. The signals over land fall-off more rapidly in winter than in summer, probably because of the lack of vegetation return in winter; but the winter and summer results over land do not differ enough to cause changes in the general conclusions for the design of radars to be constructed for future space use. No consistent difference was found between snow-covered and snow-free terrain radar returns. The oceanic returns in winter were significantly different from those in summer, with a much less rapid fall-off with angle and a lower return at vertical. This is a true seasonal bias, for the winter seas tend to be much stormier than those in summer.

N76-23642*# Arkansas Univ., Fayetteville. Dept. of Geology.
LAND USE CHANGE DETECTION WITH LANDSAT-2 DATA FOR MONITORING AND PREDICTING REGIONAL WATER QUALITY DEGRADATION Quarterly Progress Report, 28 Jan. - 27 Apr. 1976
H. C. MacDonald, Principal Investigator and K. F. Steele May 1976 6 p ERTS
(Contract NAS5-20810)
(E76-10314; NASA-CR-146826) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-23643*# Alaska Univ., Fairbanks.
TECTONIC STRUCTURE OF ALASKA AS EVIDENCED BY ERTS IMAGERY AND ONGOING SEISMICITY Progress Report
Larry D. Gedney, Principal Investigator 5 May 1976 13 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20802)
(E76-10316; NASA-CR-146827) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-23644*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Jan. - 10 Apr. 1976
George Nez, Principal Investigator 10 Apr. 1976 80 p refs ERTS
(Contract NAS5-22338)
(E76-10317; NASA-CR-147199; QR-4) Avail: NTIS HC $5.00 CSCL 08B

There are no author-identified significant results in this report.

N76-23645*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Dec. 1975 - 19 Mar. 1976
Ira S. Latimer, Jr., Principal Investigator 19 Mar. 1976 9 p Sponsored by NASA ERTS
(E76-10318; NASA-CR-147200; PR-2) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-23646*# Division of National Mapping, Canberra (Australia).
MAPPING ISLANDS, REEFS AND SHOALS IN THE OCEANS SURROUNDING AUSTRALIA Quarterly Report, 8 Feb. - 8 May 1976
Leonard G. Turner, Principal Investigator 8 May 1976 4 p Sponsored by NASA ERTS
(E76-10319; NASA-CR-147201; QR-3) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. The geometric accuracy test produced an estimate that the distortion levels on LANDSAT imagery are such that few corrections, or possibly no corrections, would be necessary in order to have the imagery satisfy accuracy specifications. It can be expected that the geometric accuracy of the low generation imagery, being used in distortion tests, in such that the distortions would cause no difficulty during the course of map preparation.

N76-23647*# Missouri Univ., Rolla.
STRUCTURAL AND GROUND PATTERN ANALYSIS OF MISSOURI AND THE OZARK DOME USING LANDSAT-2 SATELLITE IMAGERY Progress Report
Geza Kisvarsanyi and Eva B. Kisvarsanyi, Principal Investigators (Geological Survey, Rolla, Mo.) 30 Apr. 1976 12 p refs ERTS
(Contract NAS5-20937)
(E76-10320; NASA-CR-147202; PR-3) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-23648*# Geological Survey, Reston, Va.
LAND USE ANALYSIS OF US URBAN AREAS USING HIGH-RESOLUTION IMAGERY FROM SKYLAB
Daniel B. Gallagher, Principal Investigator 10 Sep. 1975 32 p refs Presented at Skylab Earth Resources Experiment Package Regional Planning and Development Conf., Lafayette, Ind., 9-10 Sep. 1975 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-5290-B)
(E76-10321; NASA-CR-147654) Avail: NTIS HC $4.00 CSCL 02C

The author has identified the following significant results. The S-190B imagery from Skylab 3 permitted the detection of higher levels of land use detail than any satellite imagery previously evaluated using manual interpretation techniques. Resolution approaches that of 1:100,000 scale infrared aircraft photography, especially regarding urban areas. Nonurban areas are less distinct.

N76-23649*# Martin Marietta Corp., Denver, Colo.
EREP GEOTHERMAL Final Report
E. W. Johnston, Principal Investigator, A. L. Dunklee, and D. C. Wychgram 9 Aug. 1974 72 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS8-24000)
(E76-10322; NASA-CR-147655; MSC-05538) Avail: NTIS HC $4.50 CSCL 10B

The author has identified the following significant results. A reasonably good agreement was found for the radiometric temperatures calculated from the ground truth data and the radiometric temperatures measured by the S192 scanner. This study showed that the S192 scanner data could be used to create good thermal images, particularly with the x-5 detector array.

N76-23650*# Nebraska Univ., Lincoln.
APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA Semiannual Progress Report, Jul. - Dec. 1975
James V. Drew and Marvin P. Carlson, Principal Investigators

Dec. 1975 22 p ERTS
(Grant NGL-28-004-020)
(E76-10323; NASA-CR-147203) Avail: NTIS HC $3.50 CSCL 05A

There are no author-identified significant results in this report.

N76-23651*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF EREP DATA WITHIN THE SUSQUEHANNA RIVER BASIN Final Report, 1 May 1973 - 30 Nov. 1975
G. J. McMurtry and G. W. Petersen, Principal Investigators Jan. 1976 273 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13406)
(E76-10324; NASA-CR-147541; ORSER-SSEL-TR-2-76) Avail: NTIS HC $9.00 CSCL 08F

The author has identified the following significant results. Photography from the S190A and S190B sensors was compared, for terrain analysis. The S190B photographs were used for terrain mapping of three test areas selected as being representative of major physiographic regions in Pennsylvania. Skylab photography was superior to both LANDSAT imagery and high altitude aircraft photography for purposes of accurate location of lineaments. Analysis of Skylab imagery has shown that long lineaments originally plotted on LANDSAT images are actually made up of shorter segments. Correlation of lineaments with ore deposits was determined following the preparation of a Pennsylvania mineral deposit map. Digital wave number analysis (spatial filtering) was attempted to determine if it can be used to enhance certain subtle features, and in particular, to locate and verify lineaments. Various spectral bands and channels of the MSS digital data were evaluated for their value in the classification and thematic mapping.

N76-23652*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, Feb. - Apr. 1976
V. Klemas, Principal Investigator, D. Bartlett, W. Philpot, and G. Davis 30 Apr. 1976 15 p refs ERTS
(Contract NAS5-20983)
(E76-10325; NASA-CR-147204) Avail: NTIS HC $3.50 CSCL 05A

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 was analyzed to determine the location, type, and extent of fronts and boundaries in Delaware Bay as a function of tidal conditions. This information is being used to set up a subroutine for an oil slick movement prediction model.

N76-23653*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Quarterly Report, 2 Dec. 1975 - 2 Mar. 1976
Robert Dolan, Principal Investigator, Bruce Hayden, and Jeffrey Heywood 27 Apr. 1976 34 p ref ERTS
(Contract NAS5-20999)
(E76-10326; NASA-CR-147205) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Orientation of the shoreline segments of Assateague Island (55 km) was measured from LANDSAT 2 imagery enlarged to 1:250,000 and 1:80,000. Long term trends in shoreline dynamics were established by mapping shoreline and storm-surge penetration changes from historical low altitude aerial photography spanning four decades.

N76-23654*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.
INTERPRETATION OF REMOTE SENSING DATA IN THE BAYOU LAFOURCHE DELTA OF SOUTH LOUISIANA Annual Report, Feb. 1975 - May 1976
Charles A. Whitehurst, Principal Investigator May 1976 91 p refs ERTS
(Grant NGL-19-001-105)
(E76-10327; NASA-CR-147206) Avail: NTIS HC $5.00 CSCL 08B

There are no author-identified significant results in this report.

N76-23655*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ATCHAFALAYA RIVER BASIN STUDY. PART 5: EVALUATION OF SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND COASTAL MARSHLANDS (SKYLAB)
Robert H. Cartmill, Principal Investigator Dec. 1975 33 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E76-10328; NASA-TM-X-73053; Rept-153) Avail: NTIS HC $4.00 CSCL 08J

The author has identified the following significant results. The basic conclusion of this study is that the quality of Skylab scanner data is inferior in quality to LANDSAT MSS data. The noise confusion seriously affected the accuracy of classification of surface features. This precluded any meaningful evaluation of other features of the scanner such as the conical scan. Instrument noise greatly reduced the accuracy of classifications obtained by the pattern recognition programs.

N76-23656*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT-2 Quarterly Report, Jul. 1975 - Mar. 1976
Anwar Hossain, Principal Investigator Apr. 1976 6 p refs Sponsored by NASA and Bangladesh Natl. ERTS Comm. ERTS
(E76-10329; NASA-CR-147210; QR-3) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. LANDSAT imageries have given positive indication of new land formation in the Bay of Bengal. A map of the bay region showing depth of new formations south of Patherghata test site was prepared. Winter crop estimation of the Sylhet-Mymensingh districts was made. This estimate shows an agreement of about 93% with 1973 data of the Agriculture Department. A preliminary land use map of the Sylhet-Mymensingh area using LANDSAT imageries in conjunction with aerial photographs and ground survey was also prepared.

N76-23657*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Dec. 1975 - Feb. 1976
W. J. VanDerOord, Principal Investigator Apr. 1976 29 p refs Sponsored by NASA ERTS
(E76-10330; NASA-CR-147211; Rept-2) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N76-23658*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report
Robert N. Colwell, Principal Investigator 31 Dec. 1975 361 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Grant NGL-05-003-404)
(E76-10332; NASA-CR-147213; SSL-Ser-17-Issue-19) Avail: NTIS HC $10.50 CSCL 08H

There are no author-identified significant results in this report.

N76-23659*# Atomic Energy Commission, Dacca (Bangladesh).
A STUDY OF THE HAOR AREAS OF SYLHET-MYMENSING DISTRICTS WITH ERTS IMAGERIES (WINTER CROP ESTIMATION)
Anwar Hossain, Principal Investigator, A. M. Choudhury, A. Azim, S. Ahmed, and S. Rahman 1976 5 p refs Presented at 1st

Ann. Bangladesh Sci. Conf., Dacca, Bangladesh, 28-31 Mar. 1976 Sponsored by NASA ERTS
(E76-10333; NASA-CR-147214) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-23660*# Consiglio Nazionale delle Ricerche, Milan (Italy). Istituto per la Geofisica della Litosfera.
RESULTS OF SKYLAB INVESTIGATION OVER ITALY Final Report
R. Cassinis, G. M. Lechi, and A. M. Tonelli, Principal Investigators 23 Dec. 1975 107 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E76-10335; NASA-CR-147396) Avail: NTIS HC $5.50

The author has identified the following significant results. Multispectral high resolution photography of S190A was successfully applied to the detection of paleoriverbeds in flat lands. Results of SL-3 mission were compared to those of LANDSAT for two regional geological surveys (linear structures) on the islands of Sicily and Sardinia. On Sicily, the seasonal conditions were unfavorable for Skylab while LANDSAT played a major role in discovering long, unknown lineaments of great interest for the geodynamics of the area. On Sardinia, owing to the vegetation type and to the geomorphic conditions, the Skylab imagery was successfully employed to describe the network of linears, both regional and local. Results can be used to study the relationship between linears, actual fracturing and the occurrence of mineral deposits.

N76-23661*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING LANDSAT IMAGERY Final Report
Donald H. VonSteen, Principal Investigator and William H. Wigton Mar. 1976 206 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70251-AG)
(E76-10336; NASA-CR-147219) Avail: NTIS HC $7.75 CSCL 02C

There are no author-identified significant results in this report.

N76-23662*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN PARTS OF SOUTHERN CALIFORNIA Final Report, 23 May 1973 - 31 Jan. 1976
P. M. Merifield, Principal Investigator, D. L. Lamar, Carl Gazley, Jr. (RAND Corp., Santa Monica, Calif.), J. V. Lamar (RAND Corp., Santa Monica, Calif.), and R. H. Stratton (RAND Corp., Santa Monica, Calif.) Jan. 1976 184 p refs Original contains imagery. Orginial photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS2-7698)
(E76-10337; NASA-CR-144477) Avail: NTIS HC $7.50 CSCL 08G

The author has identified the following significant results. Four previously unknown faults were discovered in basement terrane of the Peninsular Ranges. These have been named the San Ysidro Creek fault, Thing Valley fault, Canyon City fault, and Warren Canyon fault. In addition fault gouge and breccia were recognized along the San Diego River fault. Study of features on Skylab imagery and review of geologic and seismic data suggest that the risk of a damaging earthquake is greater along the northwestern portion of the Elsinore fault than along the southeastern portion. Physiographic indicators of active faulting along the Garlock fault identifiable in Skylab imagery include scarps, linear ridges, shutter ridges, faceted ridges, linear valleys, undrained depressions and offset drainage. The following previously unrecognized fault segments are postulated for the Salton Trough Area: (1) An extension of a previously known fault in the San Andreas fault set located southeast of the Salton Sea; (2) An extension of the active San Jacinto fault zone along a tonal change in cultivated fields across Mexicali Valley (the tonal change may represent different soil conditions along opposite sides of a fault). For the Skylab and LANDSAT images studied, pseudocolor transformations offer no advantages over the original images in the recognition of faults in Skylab and LANDSAT images. Alluvial deposits of different ages, a marble unit and iron oxide gossans of the Mojave Mining District are more readily differentiated on images prepared from ratios of individual bands of the S-192 multispectral scanner data. The San Andreas fault was also made more distinct in the 8/2 and 9/2 band ratios by enhancement of vegetation differences on opposite sides of the fault. Preliminary analysis indicates a significant earth resources potential for the discrimination of soil and rock types, including mineral alteration zones. This application should be actively pursued.

N76-23663*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY
James P. Scherz (Wis. Univ.), Douglas R. Crane (Wis. Univ.), and Robert H. Rogers Sep. 1975 27 p refs Presented at the Intern. Conf. on Environ. Sensing and Assessment, Las Vegas, Nev. 14-19 Sep. 1975
(Contract NAS5-20942)
(NASA-CR-144752; BSR-4197) Avail: NTIS HC $4.00 CSCL 08H

A technique in which LANDSAT measurements from very clear lakes are subtracted from measurements from other lakes in order to remove atmospheric and surface noise effects to obtain a residual signal dependent only on the material suspended in the water is described. This residual signal is used by the Multispectral Data Analysis System as a basis for producing color categorized imagery showing lakes by type and concentration of suspended material. Several hundred lakes in the Madison and Spooner, Wisconsin area were categorized for tannin or non-tannin waters and for the degree of algae, silt, weeds, and bottom effects. Author

N76-23664*# Ambionics, Inc., Washington, D.C.
SURVEY AND ANALYSIS OF POTENTIAL USERS OF REMOTE SENSING DATA Final Report
12 Nov. 1975 222 p refs
(Contract NASw-2756)
(NASA-CR-147927) Avail: NTIS HC $7.75 CSCL 05B

Remote sensing applications for the activities of the regional interstate organizations, the federal agencies, and the private sector are examined. The survey covered activities in all 50 states. Emphasis has been placed on on-going operational programs and no attempt was made to cover the activities of the federal agencies except insofar as they impinged on State or other regional or metropolitan programs. Author

N76-23665*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
GEOS-3 PHASE B GROUND TRUTH SUMMARY
C. L. Parsons and L. R. Goodman (NOAA, Rockville, Md.) Nov. 1975 262 p refs
(NASA-TM-X-69360) Avail: NTIS HC $9.00 CSCL 05B

Ground truth data collected during the experiment systems calibration and evaluation phase of the Geodynamics experimental Ocean Satellite (GEOS-3) experiment are summarized. Both National Weather Service analyses and aircraft sensor data are included. The data are structured to facilitate the use of the various data products in calibrating the GEOS-3 radar altimeter and in assessing the altimeter's sensitivity to geophysical phenomena. Brief statements are made concerning the quality and completeness of the included data. Author

N76-23666*# Kanner (Leo) Associates, Redwood City, Calif.
FUNDAMENTALS OF THE METHOD OF FORECASTING THE HARVEST OF WINTER GRAIN CROPS IN THE NON-CHERNOZEM ZONE
M. S. Kulik Washington NASA May 1976 44 p refs Transl. into ENGLISH from Tr. Inst. Eksperimental'nogo Meteorol. (Leningrad), no. 8, 1969 p 3-21
(Contract NASw-2790)
(NASA-TT-F-17039) Avail: NTIS HC $4.00 CSCL 02C

Many data are given on various aspects of winter crop yields

in different areas of the U.S.S.R., and connections with various soil and climatic factors are presented. Regression equations are formulated and tested with good results, for forecasting moisture supplies in the 20 cm plowed layer of soil. Data and discussions are presented on the effect of the fall growing period, thermal conditions, conditions at the start of spring, spring growing conditions and of improvement in agricultural technology on winter crop harvests. Author

N76-23667*# Transemantics, Inc., Washington, D.C.
SATELLITES MAP THE HARVEST
Eric Dyring NASA May 1976 17 p Transl. into ENGLISH from Forsch. och Fransteg (Germany), no. 3, 1976 p 46-51
(Contract NASw-2792)
(NASA-TT-F-15498) Avail: NTIS HC $3.50 CSCL 02C

Some few of the world's countries dominate the international food market by virtue of their overwhelming agricultural and technical resources. This creates what has been called food power, which is assuming increasing strategic importance in world politics. At the same time, a large part of the world's population suffers from lack of food. The way toward a just distribution of the world's food is through political decisions, but this can be broadened with the help of modern technology. In the United States, a large project has been working for more than a year to map harvests with the help of satellite observations and large-scale analysis techniques. Such methods can be effective aids against hunger in the world at the same time as they threaten to become a weapon in the struggle of the great powers in the world arena. Author

N76-23668*# Lockheed Electronics Co., Plainfield, N.J.
CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING (CITARS). VOLUME 10: INTERPRETATION OF RESULTS
R. M. Bizzell, A. H. Feiveson, F. G. Hall, M. E. Bauer (Purdue Univ.), B. J. Davis (Purdue Univ.), W. A. Malila (Environ. Res. Inst. of Michigan, Ann Arbor), and D. P. Rice (Environ. Res. Inst. of Michigan, Ann Arbor) Dec. 1975 107 p refs
(Contract NAS9-12200)
(NASA-CR-147718; LEC-4326h-Vol-10; JSC-09393-Vol-10) Avail: NTIS HC $5.50 CSCL 02C

The CITARS was an experiment designed to quantitatively evaluate crop identification performance for corn and soybeans in various environments using a well-defined set of automatic data processing (ADP) techniques. Each technique was applied to data acquired to recognize and estimate proportions of corn and soybeans. The CITARS documentation summarizes, interprets, and discusses the crop identification performances obtained using (1) different ADP procedures; (2) a linear versus a quadratic classifier; (3) prior probability information derived from historic data; (4) local versus nonlocal recognition training statistics and the associated use of preprocessing; (5) multitemporal data; (6) classification bias and mixed pixels in proportion estimation; and (7) data with differnt site characteristics, including crop, soil, atmospheric effects, and stages of crop maturity. Author

N76-23669*# Old Dominion Univ. Research Foundation, Norfolk, Va.
APPLICATION OF SATELLITE DATA AND LARS'S DATA PROCESSING TECHNIQUES TO MAPPING VEGETATION OF THE DISMAL SWAMP M.S. Thesis - Old Dominion Univ.
Jeffrey Allan Messmore May 1976 75 p refs
(Grant NGL-47-003-067)
(NASA-CR-147951; PGSTR-AP76-31) Avail: NTIS HC $4.50 CSCL 08B

The feasibility of using digital satellite imagery and automatic data processing techniques as a means of mapping swamp forest vegetation was considered, using multispectral scanner data acquired by the LANDSAT-1 satellite. The site for this investigation was the Dismal Swamp, a 210,000 acre swamp forest located south of Suffolk, Va. on the Virginia-North Carolina border. Two basic classification strategies were employed. The initial classification utilized unsupervised techniques which produced a map of the swamp indicating the distribution of thirteen forest spectral classes. These classes were later combined into three informational categories: Atlantic white cedar (Chamaecyparis thyoides), Loblolly pine (Pinus taeda), and deciduous forest. The subsequent classification employed supervised techniques which mapped Atlantic white cedar, Loblolly pine, deciduous forest, water and agriculture within the study site. A classification accuracy of 82.5% was produced by unsupervised techniques compared with 89% accuracy using supervised techniques. Author

N76-23670# Committee on Science and Technology (U. S. House).
THE ENERGY RELATED APPLICATIONS OF HELIUM
Washington 1975 578 p refs Hearing before Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 10, 7 May 1975
(GPO-54-198) Avail: Subcomm. on Energy Res., Development and Demonstration

The limited supplies and conservation of helium are considered in terms of potential energy related uses. Technologies utilizing helium considered include: superconducting power transmission, superconducting magnetic energy storage and fusion reactors. Cumulative helium requirements are estimated through the year 2030 along with the cost of extracting helium from the atmosphere and natural gas. Private storage of excess helium to meet future demands is recommended. J.M.S.

N76-23671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF VEGETATION AND SOIL USING MICROWAVE ELLIPSOMETRY Patent Application
Siegfried O. Auer (NAS-NRC) and John B. Schutt, inventors (to NASA) Filed 15 Apr. 1976 15 p
(Contract NSR-09-01-087)
(NASA-Case-GSC-11976-1; US-Patent-Appl-SN-677352) Avail: NTIS HC $3.50 CSCL 14B

A method of determining vegetation height and water content of vegetation from the intensity and state of elliptical polarization of a reflected train of microwaves is described. The method comprises the steps of reflecting a circularly polarized train of microwaves from vegetation at a predetermined angle of incidence, detecting the reflected train of microwaves, determining the ratio of the intensities of the electric field vector components, measuring the phase difference of the components, and computing the refractive index and thickness of the layer of vegetation from a formula, wherein the refractive index is given essentially by the water content of the vegetation. NASA

N76-23672*# Texas A&M Univ., College Station. Remote Sensing Center.
OPERATION OF AGRICULTURAL TEST FIELDS FOR STUDY OF STRESSED CROPS BY REMOTE SENSING Final Report, 1 Jun. 1973 - 30 Sep. 1974
Robert W. Toler 10 Oct. 1974 62 p refs
(Contract NAS9-13545)
(NASA-CR-147710) Avail: NTIS HC $4.50 CSCL 02C

A test site for the study of winter wheat development and collection of ERTS data was established in September of 1973. The test site is a 10 mile square area located 12.5 miles west of Amarillo, Texas on Interstate Hwy. 40, in Randall and Potter counties. The center of the area is the Southwestern Great Plains Research Center at Bushland, Texas. Within the test area all wheat fields were identified by ground truth and designated irrigated or dryland. The fields in the test area other than wheat were identified as to pasture or the crop that was grown. A ground truth area of hard red winter wheat was established west of Hale Center, Texas. Maps showing the location of winter wheat fields in excess of 40 acres in size within a 10 mile radius were supplied NASA. Satellite data was collected for this test site (ERTS-1). Author

N76-23673*# Technicolor Graphics, Inc., Sioux Falls, S. Dak.
AUTHOR INDEX TO PUBLISHED ERTS-1 REPORTS
Timothy C. Bidwell and Cheryl A. Mitchell 15 Oct. 1975 88 p Sponsored in part by NASA
(Contract DI-14-8-001-14790)
(NASA-CR-147341; PB-248294/1; USGS-LI-75-018) Avail: NTIS HC $5.00 CSCL 05B

This index has been compiled to assist the reader in locating and obtaining reports on the 334 scientific experiments conducted under the National Aeronautics and Space Administration (NASA) Earth Resources Technology Satellite-1 (ERTS-1) (renamed

LANDSAT) program. It lists the reports that have been published between April 1972 and September 1975. Each of the documents can be purchased from the National Technical Information Service (NTIS). GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-23674 British Library Lending Div., Boston Spa (England).
HEAT RECOVERY TECHNIQUES IN AIR-CONDITIONING PLANTS
H. Juettemann [1975] 33 p Transl. into ENGLISH from Heiz.-Lueft. Haustechn. (West Germany), v. 25, no. 8, Aug. 1974 p 243-252
(BLL-OA-Trans-2002-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

Because of increasing energy prices, greater importance has become attached to heat recovery. As a result of the change which has occurred in cost relationships, the range of economic application of heat recovery methods has been considerably extended. Equipment and methods employed for heat recovery are reviewed and their various methods of operation are discussed. Author

N76-23675* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY POWER SYSTEM Patent
Billy K. Davis, inventor (to NASA) Issued 18 May 1976 8 p Filed 21 Mar. 1975 Supersedes N75-29548 (13 - 20, p 2541) Division of US Patent Appl. SN-421702, filed 4 Dec. 1973, US - Patent-3,903,699
(NASA-Case-MFS-21628-2; US-Patent-3,957,030; US-Patent-Appl-SN-561020; US-Patent-Class-126-270; US-Patent-Class-165-133; US-Patent-Appl-SN-421702; US-Patent-3,903,699) Avail: US Patent Office CSCL 10A

A solar energy vapor (Freon) powered system is described for generating electrical energy in which a portion of the heat absorbed from the sun in daylight is stored for use during darkness by a thermal capacitor in which a mass of Pyrone, having a high thermal capacity, liquifies when heat is applied to it and goes through a solidification process to provide a heat output. A highly efficient solar boiler is constructed utilizing an anodized titanium surface and a particular combination of shaped boiler tubes and complementary reflectors. The overall efficiency of the system is further improved by a unique arrangement of heat recovery devices. Official Gazette of the U.S. Patent Office

N76-23676 British Library Lending Div., Boston Spa (England).
PROBLEMS OF INCREASING THE OUTPUT OF SYNCHRONOUS TURBO-GENERATORS PARTICULARLY THOSE WITH SUPERCONDUCTIVE FIELD WINDINGS
J. Sergl 1975 17 p refs Transl. into ENGLISH from Bull. de l'Assoc. Suisse des Electriciens (Germany), v. 66, no. 6, 22 Mar. 1975 p 318-323
(BLL-CE-Trans-6813-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Development of synchronous turbogenerators with superconductive field windings is discussed in terms of increasing the electrical power output. The basic construction of a turbogenerator is described. The fields of the generator with superconductive exciter windings are calculated along with the characteristic reactances of the generators. It is indicated that further development of the synchronous turbogenerator can supply the projected increase in demand for electrical power. J.M.S.

N76-23677 Tennessee Univ., Knoxville.
MODELING OF OPERATING FOSSIL FIRED POWER PLANTS: AN APPLICATIONS APPROACH Ph.D. Thesis
George Franklin Pierce 1975 114 p
Avail. Univ. Microfilms Order No. 76-11081

Suitable models of several existing control loops in an operating fossil fired plant are developed. Parameters for these models are developed without disruptive tests. A unique application of describing function analysis is developed and applied to the governor system. Capacity and dynamic models of the pulverizer system are developed. A new control strategy for the pulverizer system is proposed and studied. The models developed are used to demonstrate how improved plant control, reliability and economy could be achieved. Dissert. Abstr.

N76-23678*# Ionics, Inc., Watertown, Mass. Research Div.
ANION PERMSELECTIVE MEMBRANE Summary Report
Samuel S. Alexander, Richard R. Geoffroy, and Russell Hodgdon [1975] 85 p refs
(Contract NAS3-18897)
(NASA-CR-134931) Avail: NTIS HC $5.00 CSCL 10C

Experimental anion permselective membranes were prepared and tested for their suitability as cell separators in a chemical redox power storage system being developed at NASA-Lewis Research Center. The goals of long-term (1000 hr) oxidative and thermal stability at 80 C in FeC13 and CrC13 electrolytes were met by most of the weak base and strong base amino exchange groups considered in the program. Good stability was also shown by several of the membrane substrate resins. These were 'styrene' divinylbenzene copolymer and PVC films. At least 4 membrane systems produced strong flexible films with electrochemical properties (resistivity, cation transfer) superior to those of the 103QZL, the present front runner membrane. The experimental systems also possessed good potential for control and improvement of transport properties and resin stability. Author

N76-23679*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Report
J. C. Corman Feb. 1976 54 p Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-1; SRD-76-011-Vol-1) Avail: NTIS HC $4.50 CSCL 10B

A data base for the comparison of advanced energy conversion systems for utility applications using coal or coal-derived fuels was developed. Estimates of power plant performance (efficiency), capital cost, cost of electricity, natural resource requirements, and environmental intrusion characteristics were made for ten advanced conversion systems. Emphasis was on the energy conversion system in the context of a base loaded utility power plant. All power plant concepts were premised on meeting emission standard requirements. A steam power plant (3500 psig, 1000 F) with a conventional coal-burning furnace-boiler was analyzed as a basis for comparison. Combined cycle gas/steam turbine system results indicated competitive efficiency and a lower cost of electricity compared to the reference steam plant. The Open-Cycle MHD system results indicated the potential for significantly higher efficiency than the reference steam plant but with a higher cost of electricity. Author

N76-23680*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS. PART 1: OPEN-CYCLE GAS TURBINES Final Report
D. H. Brown and J. C. Corman Feb. 1976 97 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-2-Pt-1; SRD-76-011-Vol-2-Pt-1) Avail: NTIS HC $5.00 CSCL 10B

Ten energy conversion systems are defined and analyzed in terms of efficiency. These include: open-cycle gas turbine recuperative; open-cycle gas turbine; closed-cycle gas turbine; supercritical CO2 cycle; advanced steam cycle; liquid metal topping cycle; open-cycle MHD; closed-cycle inert gas MHD;

closed-cycle liquid metal MHD; and fuel cells. Results are presented. J.M.S.

N76-23681*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS. PART 2: CLOSED TURBINE CYCLES Final Report
D. H. Brown, J. C. Corman, and R. B. Fleming Feb. 1976 96 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-2-Pt-2; SRD-76-011-Vol-2-Pt-2) Avail: NTIS HC $5.00 CSCL 10B
For abstract, see N76-23680.

N76-23682*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS. PART 3: DIRECT ENERGY CONVERSION CYCLES Final Report
J. C. Corman, R. B. Fleming, L. P. Harris, and R. V. Pohl Feb. 1976 142 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-2-Pt-3; SRD-76-011-Vol-2-Pt-3) Avail: NTIS HC $6.00 CSCL 10B
For abstract, see N76-23680.

N76-23683*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 3: ENERGY CONVERSION SUBSYSTEMS AND COMPONENTS. PART 1: BOTTOMING CYCLES AND MATERIALS OF CONSTRUCTION Final Report
R. P. Shah and H. D. Solomon Feb. 1976 86 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-3-Pt-1; SRD-76-011-Vol-3-Pt-1) Avail: NTIS HC $5.00 CSCL 10B
Energy conversion subsystems and components were evaluated in terms of advanced energy conversion systems. Results of the bottoming cycles and materials of construction studies are presented and discussed. J.M.S.

N76-23684*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 3: ENERGY CONVERSION SUBSYSTEMS AND COMPONENTS. PART 2: PRIMARY HEAT INPUT SYSTEMS AND HEAT EXCHANGERS Final Report
J. C. Corman, J. H. Eskesen, A. S. Robertson, and R. D. Stewart Feb. 1976 206 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-3-Pt-2; SRD-76-011-Vol-3-Pt-2) Avail: NTIS HC $7.75 CSCL 10B
Primary heat input systems and heat exchangers were evaluated for advanced energy conversion systems. Results are presented and discussed. J.M.S.

N76-23685*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), GENERAL ELECTRIC PHASE 1. VOLUME 3: ENERGY CONVERSION SUBSYSTEMS AND COMPONENTS. PART 3: GASIFICATION, PROCESS FUELS, AND BALANCE OF PLANT Final Report
W. A. Boothe, J. C. Corman, G. G. Johnson, and T. A. V. Cassel Feb. 1976 174 p refs Sponsored in part by ERDA and NSF 3 Vol.
(Contract NAS3-19406)
(NASA-CR-134948-Vol-3-Pt-3; SRD-76-011-Vol-3-Pt-3) Avail: NTIS HC $6.75 CSCL 10B
Results are presented of an investigation of gasification and clean fuels from coal. Factors discussed include: coal and coal transportation costs; clean liquid and gas fuel process efficiencies and costs; and cost, performance, and environmental intrusion elements of the integrated low-Btu coal gasification system. Cost estimates for the balance-of-plant requirements associated with advanced energy conversion systems utilizing coal or coal-derived fuels are included. J.M.S.

N76-23686*# United Technologies Corp., South Windsor, Conn.
DEVELOPMENT OF ADVANCED FUEL CELL SYSTEM (PHASE 4) Final Report, 20 Feb. - 31 Dec. 1975
A. P. Meyer and W. F. Bell 31 Jan. 1976 98 p
(Contract NAS3-15339)
(NASA-CR-135030; FCR-0165) Avail: NTIS HC $5.00 CSCL 10A
A multiple-task research and development program was performed to improve the weight, life, and performance characteristics of hydrogen-oxygen alkaline fuel cells for advanced power systems. During Phase 4, the lowest stabilized degradation rate observed in all the testing completed during four phases of the program, 1 microvolt/hour, was demonstrated. This test continues after 5,000 hours of operation. The cell incorporates a PPf anode, a 90Au/10Pt cathode, a hybrid frame, and a Fybex matrix. These elements were developed under this program to extend cell life. The result demonstrated that the 80Au/20Pt cathode is as stable as a 90Au/10Pt cathode of twice the precious metal loading, was confirmed in full-scale cells. A hybrid frame two-cell plaque with dedicated flow fields and manifolds for all fluids was demonstrated to prevent the cell-to cell electrolyte transfer that limited the endurance of multicell plaques. At the conclusion of Phase 4, more than 90,900 hours of testing had been completed and twelve different cell designs had been evaluated. A technology base has been established which is ready for evaluation at the powerplant level. Author

N76-23687*# United Technologies Corp., South Windsor, Conn.
DEVELOPMENT OF ADVANCED FUEL CELL SYSTEM (PHASE 4) Summary Report, 20 Feb. - 31 Dec. 1975
A. P. Meyer and W. F. Bell 31 Jan. 1976 10 p
(Contract NAS3-15339)
(NASA-CR-135030S; FCR-0194) Avail: NTIS HC $3.50 CSCL 10A
For abstract, see N76-23686.

N76-23688*# Spectrolab, Inc., Sylmar, Calif.
DEMONSTRATION OF THE FEASIBILITY OF AUTOMATED SILICON SOLAR CELL FABRICATION
William E. Taylor and Fred M. Schwartz Oct. 1975 35 p
(Contract NAS3-18566)
(NASA-CR-134981) Avail: NTIS HC $4.00 CSCL 10A
A study effort was undertaken to determine the process, steps and design requirements of an automated silicon solar cell production facility. Identification of the key process steps was made and a laboratory model was conceptually designed to demonstrate the feasibility of automating the silicon solar cell fabrication process. A detailed laboratory model was designed to demonstrate those functions most critical to the question of solar cell fabrication process automating feasibility. The study and conceptual design have established the technical feasibility of automating the solar cell manufacturing process to produce low cost solar cells with improved performance. Estimates predict an automated process throughput of 21,973 kilograms of silicon a year on a three shift 49-week basis, producing 4,747,000 hexagonal cells (38mm/side), a total of 3,373 kilowatts at an estimated manufacturing cost of $0.866 per cell or $1.22 per watt. Author

N76-23689*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
THE CONCEPTUAL DESIGN OF AN INTEGRATED NUCLEARHYDROGEN PRODUCTION PLANT USING THE SULFUR CYCLE WATER DECOMPOSITION SYSTEM
G. H. Farbman Apr. 1976 208 p refs
(Contract NAS3-18934)
(NASA-CR-134976) Avail: NTIS HC $7.75 CSCL 10B
A hydrogen production plant was designed based on a hybrid electrolytic-thermochemical process for decomposing water. The sulfur cycle water descomposition system is driven by a very high temperature nuclear reactor that provides 1,283 K helium working gas. The plant is sized to approximately ten million standard cubic meters per day of electrolytically pure hydrogen and has an overall thermal efficiently of 45.2 percent. The economics of the plant were evaluated using ground rules which include a 1974 cost basis without escalation, financing structure

and other economic factors. Taking into account capital, operation, maintenance and nuclear fuel cycle costs, the cost of product hydrogen was calculated at $5.96/std cu m for utility financing. These values are significantly lower than hydrogen costs from conventional water electrolysis plants and competitive with hydrogen from coal gasification plants. Author

N76-23690*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STANDARDIZED PERFORMANCE TESTS OF COLLECTORS OF SOLAR THERMAL ENERGY-A FLAT-PLATE COLLECTOR WITH A SINGLE-TUBE SERPENTINE FLOW DISTRIBUTION
Susan Johnson Apr. 1976 7 p
(NASA-TM-X-73417; E-8752) Avail: NTIS HC $3.50 CSCL 10A

This preliminary data report gives basic test results of a flat-plate solar collector whose performance was determined in the NASA-Lewis solar simulator. The collector was tested over ranges of inlet temperatures, fluxes and coolant flow rates. Collector efficienty is correlated in terms of inlet temperature and flux level. Author

N76-23691*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA THERMIONIC-CONVERSION PROGRAM
J. F. Morris and J. G. Lundholm (NASA, Washington) 1976 6 p refs Proposed for presentation at Eleventh Intersoc. Energy Conversion Eng. Conf., State Line, Nev., 12-17 Sep. 1976
(NASA-TM-X-73430; E-8778) Avail: NTIS HC $3.50 CSCL 10A

Current out-of-core emphases allow converter material and design freedoms previously prohibited by in-core nucleonic and geometric restrictions. As a result, potential improvements indicate possibilities for severalfold increases in efficiencies. The new TEC-ART program concentrated initially on low-work function collectors and interelectrode-loss reduction and revealed much in a short time. This new emission capability coupled with improved collectors that maintain performance with emitter-vapor deposit accumulations are requisites for efficient, enduring thermionic converters. Author

N76-23692*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 1: INTRODUCTION AND SUMMARY AND GENERAL ASSUMPTIONS Final Report
D. T. Beecher 12 Feb. 1976 225 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-1) Avail: NTIS HC $7.75 CSCL 10B

Nine advanced energy conversion concepts using coal or coal-derived fuels are summarized. They are; (1) open-cycle gas turbines, (2) combined gas-steam turbine cycles, (3) closed-cycle gas turbines, (4) metal vapor Rankine topping, (5) open-cycle MHD; (6) closed-cycle MHD; (7) liquid-metal MHD; (8) advanced steam; and (9) fuel cell systems. The economics, natural resource requirements, and performance criteria for the nine concepts are discussed. Author

N76-23693*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 2: MATERIALS CONSIDERATIONS Final Report
D. E. Thomas 12 Feb. 1976 306 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-2; Rept-76-9E9-ECAS-Rlv.2-Vol-2)
Avail: NTIS HC $9.75 CSCL 10B

Extensive studies are presented which were carried out on materials behavior in nine advanced energy conversion systems employing coal and coal-derived fuels. The areas of materials behavior receiving particular attention in this regard are: (1) fireside corrosion and erosion in boiler and heat exchanger materials, (2) oxidation and hot corrosion of gas turbine materials, (3) liquid metal corrosion and mass transport, (4) high temperature steam corrosion, (5) compatability of materials with coal slag and MHD seed, (6) reaction of materials with impure helium, (7) allowable stresses for boiler and heat exchanger materials, (8) environmental effects on mechanical properties, and (9) liquid metal purity control and instrumentation. Such information was then utilized in recommending materials for use in the critical components of the power systems, and at the same time to identify materials problem areas and to evaluate qualitatively the difficulty of solving those problems. Specific materials recommendations for critical components of the nine advanced systems under study are contained in summary tables. Author

N76-23694*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 3: COMBUSTORS, FURNACES AND LOW-BTU GASIFIERS Final Report
J. R. Hamm 12 Feb. 1976 521 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; NSF AG-551)
(NASA-CR-134941-Vol-3; Rept-76-9E9-ECAS-Rlv.3-Vol-3)
Avail: NTIS HC $12.75 CSCL 10B

Information is presented on the design, performance, operating characteristics, cost, and development status of coal preparation equipment, combustion equipment, furnaces, low-Btu gasification processes, low-temperature carbonization processes, desulfurization processes, and pollution particulate removal equipment. The information was compiled for use by the various cycle concept leaders in determining the performance, capital costs, energy costs, and natural resource requirements of each of their system configurations. Author

N76-23695*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 4: OPEN RECUPERATED AND BOTTOMED GAS TURBINE CYCLES Final Report
D. J. Amos and J. E. Grube 12 Feb. 1976 117 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-4; Rept-76-9E9-ECAS-Rlv.4-Vol-4)
Avail: NTIS HC $5.50 CSCL 10B

Open-cycle recuperated gas turbine plant with inlet temperatures of 1255 to 1644 K (1800 to 2500 F) and recuperators with effectiveness values of 0, 70, 80 and 90% are considered. A 1644 K (2500 F) gas turbine would have a 33.5% plant efficiency in a simple cycle, 37.6% in a recuperated cycle and 47.6% when combined with a sulfur dioxide bottomer. The distillate burning recuperated plant was calculated to produce electricity at a cost of 8.19 mills/MJ (29.5 mills/kWh). Due to their low capital cost $170 to 200 $/kW, the open cycle gas turbine plant should see duty for peaking and intermediate load duty. Author

N76-23696*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 5: COMBINED GAS-STEAM TURBINE CYCLES Final Report
D. J. Amos, R. W. Foster-Pegg, and R. M. Lee 12 Feb. 1976 114 p refs 2 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-5; Rept-76-9E9-ECAS-Rlv.5-Vol-5)
Avail: NTIS HC $5.50 CSCL 10B

The energy conversion efficiency of gas-steam turbine cycles was investigated for selected combined cycle power plants. Results indicate that it is possible for combined cycle gas-steam turbine power plants to have efficiencies several point higher than conventional steam plants. Induction of low pressure steam into the steam turbine is shown to improve the plant efficiency. Post firing of the boiler of a high temperature combined cycle plant is found to increase net power but to worsen efficiency. A gas turbine pressure ratio of 12 to 1 was found to be close to optimum at all gas turbine inlet temperatures that were studied. The coal using combined cycle plant with an integrated low-Btu gasifier was calculated to have a plant efficiency of 43.6%, a capitalization of $497/kW, and a cost of electricity of 6.75 mills/MJ (24.3 mills/kwh). This combined cycle plant should be considered for base load power generation. Author

N76-23697*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 6: CLOSED-CYCLE GAS TURBINE SYSTEMS Final Report
D. J. Amos, W. K. Fentress, and W. F. Stahl 12 Feb. 1976

154 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-6; Rept-76-9E9-ECAS-Rlv.6-Vol-6)
Avail: NTIS HC $6.57 CSCL 10B

Both recuperated and bottomed closed cycle gas turbine systems in electric power plants were studied. All systems used a pressurizing gas turbine coupled with a pressurized furnace to heat the helium for the closed cycle gas turbine. Steam and organic vapors are used as Rankine bottoming fluids. Although plant efficiencies of over 40% are calculated for some plants, the resultant cost of electricity was found to be 8.75 mills/MJ (31.5 mills/kWh). These plants do not appear practical for coal or oil fired plants. Author

N76-23698*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 7: METAL VAPOR RANKINE TOPPING-STEAM BOTTOMING CYCLES Final Report
P. B. Deegan 12 Feb. 1976 198 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-7; Rept-76-9E9-ECAS-Rlv.7-Vol-7)
Avail: NTIS HC $7.50 CSCL 10B

Adding a metal vapor Rankine topper to a steam cycle was studied as a way to increase the mean temperature at which heat is added to the cycle to raise the efficiency of an electric power plant. Potassium and cesium topping fluids were considered. Pressurized fluidized bed or pressurized (with an integrated low-Btu gasifier) boilers were assumed. Included in the cycles was a pressurizing gas turbine with its associated recuperator, and a gas economizer and feedwater heater. One of the ternary systems studied shows plant efficiency of 42.3% with a plant capitalization of $66.7/kW and a cost of electricity of 8.19 mills/MJ (29.5 mills/kWh). Author

N76-23699*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 8: OPEN-CYCLE MHD Final Report
D. Q. Hoover 12 Feb. 1976 439 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-8; Rept-76-9E9-ECAS-Rlv.8-Vol-8)
Avail: NTIS HC $11.75 CSCL 10B

Electric power plant costs and efficiencies are presented for three basic open-cycle MHD systems: (1) direct coal fired system, (2) a system with a separately fired air heater, and (3) a system burning low-Btu gas from an integrated gasifier. Power plant designs were developed corresponding to the basic cases with variation of major parameters for which major system components were sized and costed. Flow diagrams describing each design are presented. A discussion of the limitations of each design is made within the framework of the assumptions made. Author

N76-23700*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 9: CLOSED-CYCLE MHD Final Report
T. C. Tsu 12 Feb. 1976 224 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-9; Rept-76-9E9-ECAS-Rlv.9-Vol-9)
Avail: NTIS HC $7.75 CSCL 10B

A closed-cycle MHD system for an electric power plant was studied. It consists of 3 interlocking loops, an external heating loop, a closed-cycle cesium seeded argon nonequilibrium ionization MHD loop, and a steam bottomer. A MHD duct maximum temperature of 2366 K (3800 F), a pressure of 0.939 MPa (9.27 atm) and a Mach number of 0.9 are found to give a topping cycle efficiency of 59.3%; however when combined with an integrated gasifier and optimistic steam bottomer the coal to bus bar efficiency drops to 45.5%. A 1978 K (3100 F) cycle has an efficiency of 55.1% and a power plant efficiency of 42.2%. The high cost of the external heating loop components results in a cost of electricity of 21.41 mills/MJ (77.07 mills/kWh) for the high temperature system and 19.0 mills/MJ (68.5 mills/kWh) for the lower temperature system. It is, therefore, thought that this cycle may be more applicable to internally heated systems such as some futuristic high temperature gas cooled reactor. Author

N76-23701*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 10: LIQUID-METAL MHD SYSTEMS Final Report
R. R. Holman and T. E. Lippert 12 Feb. 1976 200 p 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-10; Rept-76-9E9-ECAS-Rlv.10-Vol-10)
Avail: NTIS HC $7.50 CSCL 10B

Electric Power Plant costs and efficiencies are presented for two basic liquid-metal cycles corresponding to 922 and 1089 K (1200 and 1500 F) for a commercial applications using direct coal firing. Sixteen plant designs are considered for which major component equipment were sized and costed. The design basis for each major component is discussed. Also described is the overall systems computer model that was developed to analyze the thermodynamics of the various cycle configurations that were considered. Author

N76-23702*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 11: ADVANCED STEAM SYSTEMS Final Report
R. W. Wolfe 12 Feb. 1976 315 p 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-11; Rept-76-9E9-ECAS-Rlv.11-Vol-11)
Avail: NTIS HC $9.75 CSCL 10B

A parametric analysis was made of three types of advanced steam power plants that use coal in order to have a comparison of the cost of electricity produced by them a wide range of primary performance variables. Increasing the temperature and pressure of the steam above current industry levels resulted in increased energy costs because the cost of capital increased more than the fuel cost decreased. While the three plant types produced comparable energy cost levels, the pressurized fluidized bed boiler plant produced the lowest energy cost by the small margin of 0.69 mills/MJ (2.5 mills/kWh). It is recommended that this plant be designed in greater detail to determine its cost and performance more accurately than was possible in a broad parametric study and to ascertain problem areas which will require development effort. Also considered are pollution control measures such as scrubbers and separates for particulate emissions from stack gases. Author

N76-23703*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), WESTINGHOUSE PHASE 1. VOLUME 12: FUEL CELLS Final Report
C. J. Warde, R. J. Ruka, and A. O. Isenberg 12 Feb. 1976 191 p refs 12 Vol.
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134941-Vol-12; Rept-76-9E9-ECAS-Rlv.12-Vol-12)
Avail: NTIS HC $7.50 CSCL 10B

A parametric assessment of four fuel cell power systems -- based on phosphoric acid, potassium hydroxide, molten carbonate, and stabilized zirconia -- has shown that the most important parameters for electricity-cost reduction and/or efficiency improvement standpoints are fuel cell useful life and power density, use of a waste-heat recovery system, and fuel type. Typical capital costs, overall energy efficiencies (based on the heating value of the coal used to produce the power plant fuel), and electricity costs are: phosphoric acid $350-450/kWe, 24-29%, and 11.7 to 13.9 mills/MJ (42 to 50 mills/kWh); alkaline $450-700/kWe, 26-31%, and 12.8 to 16.9 mills/MJ (46 to 61 mills/kWh); molten carbonate $480-650/kWe, 32-46%, and 10.6 to 19.4 mills/MJ (38 to 70 mills/kWh), stabilized zirconia $420-950/kWe, 26-53%, and 9.7 to 16.9 mills/MJ (35 to 61 mills/kWh). Three types of fuel cell power plants -- solid electrolytic with steam bottoming, molten carbonate with steam bottoming, and solid electrolyte with an integrated coal gasifier -- are recommended for further study. Author

N76-23704*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW WORK FUNCTION SILICON COLLECTOR FOR THERMIONIC CONVERTERS

K. H. Chang and K. Shimada 15 May 1976 34 p refs (Contract NAS7-100)
(NASA-CR-147947; JPL-TM-33-775) Avail: NTIS HC $4.00 CSCL 10A

To improve the efficiency of present thermionic converters, single crystal silicon was investigated as a low work function collector material. The experiments were conducted in a test vehicle which resembled an actual thermionic converter. Work function as low as 1.0eV was obtained with an n-type silicon. The stabilities of the activated surfaces at elevated temperatures were tested by raising the collector temperature up to 829 K. By increasing the Cs arrival rate, it was possible to restore the originally activated low work function of the surface at elevated surface temperatures. These results, plotted in the form of Rasor-Warner curve, show a behavior similar to that of metal electrode except that the minimum work function was much lower with silicon than with metals. Author

N76-23705# Committee on Government Operations (U. S. House).
FEDERAL PREPAREDNESS TO DEAL WITH THE US NATURAL GAS SHORTAGE EMERGENCY
Washington GPO 1975 855 p refs Hearings before a subcomm. of the Comm. on Govt. Operations, 94th Congr., 1st Sess., 12 and 26 Jun. 1975
(GPO-55-778) Avail: SOD HC $6.70

Testimony and reports regarding the problems of natural gas supply and demand are presented. Implications of shortages for consumers and industries are considered. Government actions and proposals, particularly the deregulation of prices, which are designed to encourage the conservation of and to increase the supply of natural gas are discussed. D.M.L.

N76-23706# Committee on Government Operations (U. S. House).
LASER FUSION: A SOLUTION TO THE NATURAL GAS SHORTAGE?
Washington GPO 1975 145 p Hearings before a subcomm. of the Comm. on Govt. Operations, 94th Congr., 1st Sess., 3 Jun. 1975
(GPO-57-568) Avail: Comm. on Govt. Operations

Testimony regarding the use of laser fusion for energy production is presented. The fundamental principles of laser fusion technology are described and the use of fusion for electric power generation and the production of synthane, hydrogen, and other hydrogen based fuels are discussed. The use of laser beams for the enrichment of uranium for fission reactors is also considered. D.M.L.

N76-23707# Committee on Government Operations (U. S. House).
INVESTIGATIVE HEARINGS ON ENERGY AND ENVIRONMENTAL ACTIVITIES OF FEDERAL AGENCIES DURING 1975, PART 1
Washington GPO 1975 672 p refs Hearings before a subcomm. of the Comm. on Govt. Operations, 94th Congr., 1st Sess., 10, 24 Apr.; 9 May; 17 Jun. 1975
(GPO-57-928) Avail: SOD HC $5.40

Testimony and reports regarding energy policy and environment protection are presented. Primary emphasis is placed on the conservation of energy and the reduction of dependence on foreign oil sources. The activities of Federal agencies in this regard are described. The problem of water pollution is also discussed and EPA evaluations of specific proposals for water resource development are included. D.M.L.

N76-23708# Arizona Univ., Tucson. Engineering Experiment Station.
POWER GENERATION IN ARIZONA AND ITS ENVIRONMENTAL IMPLICATIONS
Stephen Edgerly Smith [1976] 229 p refs
(EES-47) Avail: NTIS HC $8.00

Electric power production for Arizona was studied through an examination of all generating stations on-line and in-planning through 1985. The environmental impacts associated with each of the four major plant types (hydroelectric, fossil-fueled, nuclear, and gas turbine) are discussed. Individual power generation facilities serving Arizona are identified by location, ownership, installed capacity, and plant type. The environmental implications inherent to each individual facility were examined in regard to air quality, land use, water consumption and fuel supply. Additionally, the general characteristics and problems associated with power production and transmission by electric utilities are reviewed. Author

N76-23709*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED SOLAR CELL GRID PATTERNS Patent Application
Robert K. Yasui (JPL) and Paul A. Berman, inventors (to NASA) (JPL) Filed 19 Apr. 1974 21 p Sponsored by NASA
(NASA-Case-NPO-13087-2; US-Patent-Appl-SN-462341) Avail: NTIS HC $3.50 CSCL 10A

A grid pattern for a solar cell of the type including a semiconductive layer doped to a first polarity and a top counter-doped layer is discribed. The grid pattern comprises a plurality of concentric conductive grids of selected geometric shapes which are centered about the center of the exposed active surface of the counter-doped layer. Connected to the grids are one or more conductors which extend to the cell's periphery. For the pattern area, the grids and conductors are arranged in the pattern to minimize the maximum distance which any injected majority carriers have to travel to reach any of the grids or conductors. The pattern has a multi-axes symmetry with respect to the cell center to minimize the maximum temperature differentials between points on the cell surface and to provide a more uniform temperature distribution across the cell face. NASA

N76-23710# Committee on Interior and Insular Affairs (U. S. House).
OVERSIGHT HEARINGS ON NUCLEAR ENERGY: INTERNATIONAL PROLIFERATION OF NUCLEAR TECHNOLOGY, PART 3
Washington GPO 1975 120 p refs Hearings before Subcomm. on Energy and the Environment of Comm. on Interior and Insular Affairs, 94th Congr., 1st Sess., 21, 22, and 24 Jul. 1975
(GPO-58-242) Avail: Subcomm. on Energy and the Environment

Safeguard standards to insure that no nation can use its newly acquired nuclear technology for creating nuclear weapons and to prevent weapons-grade nuclear materials from being diverted by governments or terrorist groups are considered. Factors discussed include: the international framework in which nuclear exports take place; the status International Atomic Energy Agency set up by the Non-Proliferation Treaty; the export of American nuclear technology; and the technological and foreign policy challenges of nuclear proliferation. Recommendations and solutions are proposed. J.M.S.

N76-23711# Select Committee on Small Business (U. S. Senate).
ENERGY RESEARCH AND DEVELOPMENT AND SMALL BUSINESS. PART 1C: APPENDIXES
Washington GPO 1975 1141 p refs Hearings before Select Comm. on Small Business, 94th Congr., 1st Sess., 13-14 May 1975
(GPO-56-516) Avail: SOD HC $10.25

General information concerning solar energy covers technological and scientific research studies as well as legislative activities and science policies. Emphasis is placed on solar heating and cooling of buildings. G.G.

N76-23712# Select Committee on Small Business (U. S. Senate).
ENERGY RESEARCH AND DEVELOPMENT AND SMALL BUSINESS. PART 1D: APPENDIXES
Washington GPO 1975 588 p refs Hearings before Select Comm. on Small Business, 94th Congr., 1st Sess., 13-14 May 1975
(GPO-56-516) Avail: SOD HC $4.85

The solar Energy Task Force REport for the Project Independence Blueprint Study concludes that economically viable solar energy conversion systems can be developed and installed in substantial numbers well before the year 2000 to provide significant quantities of energy and power for the United States. R&D programs and implementation scenarios are described for six technically feasible solar energy technologies for heating and

cooling buildings, providing high temperature heat, and producing electric power or clean fuels. The report emphasizes the widespread, domestic, long term, reliable availability of solar energy resources, and the general environmental acceptability of solar energy power systems. Finally, the report outlines the types of solar energy research, technology development, and system implementation needed to help meet the objectives of Project Independence. Author

N76-23713*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTI-CELL BATTERY PROTECTION SYSTEM Patent Application
Ralph D. Thomas and William J. Nagle, inventors (to NASA) Filed 19 May 1976 14 p
(NASA-Case-LEW-12039-1; US-Patent-Appl-SN-687822) Avail: NTIS HC $3.50 CSCL 10C

A multi-cell battery protection system is provided wherein each cell has its own individual protective circuit. The protective circuits each comprise a solid state comparator unit and a high current switching device such as a relay. The comparator units each continuously monitor the associated cell and when the cell voltage either exceeds a predetermined 'high' level or falls below a predetermined 'low' level, the relay is actuated whereby a bypass circuit is completed across the cell thereby effectively removing the cell from the series of cells. NASA

N76-23714# Battelle Pacific Northwest Labs., Richland, Wash.
MHD MATERIALS TESTING AND CHARACTERIZATION: WHY, HOW AND WHERE
J. L. Bates [1975] 10 p Presented at the US-USSR Colloq. Panel, Washington, D. C., 5 Jun. 1975
(Contract AT(45-1)-1830)
(BNWL-SA-5503; Conf-750669-1) Avail: NTIS HC $4.00

The major emphasis in MHD is devoted principally to the demonstration of engineering and fundamental feasibility of MHD systems, principally in generator development. For this reason, testing of materials in these MHD systems is generally given a secondary role. However, the need for a comprehensive materials research and development program is becoming more evident, especially programs involving the evaluation of materials under MHD environments. The need for correlated planning in testing and characterization of MHD materials so as to derive the maximum benefit is discussed. ERA

N76-23715# Argonne National Lab., Ill.
COMPARISON OF SOLAR CONCENTRATORS
A. Rabl Apr. 1975 62 p refs
(Contract W-31-109-eng-38)
(ANL-SOL-75-02) Avail: NTIS HC $5.50

Even though most variations of solar concentrators have been studied or built at some time or other, an important class of concentrators has been overlooked until very recently. These novel concentrators have been called ideal on account of their optical properties, and an example, the compound parabolic concentrator, was tested at Argonne National Laboratory. Ideal concentrators differ radically from conventional instruments such as focussing parabolas. They act as radiation funnel and do not have a focus. For a given acceptance angle their concentration surpasses that of other solar concentrators by a factor of two to four, but a rather large reflector area is required. The number of reflections varies with angle of incidence, with an average value around one in most cases of interest. In order to help provide a rational basis for deciding which concentrator type is best suited for a particular application, a variety of solar concentrators were compared in terms of their most important general characteristics, namely concentration, acceptance angle, sensitivity to mirror errors, size of reflector area and average number of reflections. Author (ERA)

N76-23716# Argonne National Lab., Ill.
HIGH-PERFORMANCE BATTERIES FOR OFF-PEAK ENERGY STORAGE AND ELECTRIC-VEHICLE PROPULSION Progress Report, Jul. - Dec. 1974
Jul. 1975 145 p refs
(Contract W-31-109-eng-38)
(ANL-75-1) Avail: NTIS HC $7.60

Recent effort in the development of engineering-scale cells focused on increasing the specific power and lifetime capabilities of the cells and on improving assembly and startup procedures. Work on electrode development was directed toward evaluation of electrode designs for the two applications, improvements in current collection, and the effects of other metal sulfides as additives to the positive electrodes. Materials studies included improvements in the design of feedthroughs, corrosion testing of candidate construction materials, and postoperative examinations of cells operated in other parts of the program. Cell chemistry studies were directed toward investigations of cell reactions and development of a method for preparing LiCl-KCl electrolyte of suitable purity. Battery design work included development of specifications for a battery for electric vehicle propulsion, design of a battery for testing on a utility network, and evaluation of materials and manufacturing costs. Author (ERA)

N76-23717# Argonne National Lab., Ill.
OPTICAL AND THERMAL PROPERTIES OF COMPOUND PARABOLIC CONCENTRATORS
A. Rabl Feb. 1975 50 p refs
(Contract W-31-109-eng-38)
(ANL-SOL-75-01) Avail: NTIS HC $5.00

Compound parabolic concentrators (CPC) are relevant for solar energy collection because they achieve the highest possible concentration for any acceptance angle (tracking requirement). The convective and radiative heat transfer through a CPC are calculated, and formulas are presented for evaluating the performance of solar collectors based on the CPC principle. A simple analytic technique is developed for calculating the average number of reflections for radiation passing through a CPC; this information is necessary for computing optical losses. In most practical applications, a CPC will be truncated because a large portion of the reflector area can be eliminated without seriously reducing the concentration. The effects of this truncation are described explicitly. Author (ERA)

N76-23718# California Univ., Livermore. Lawrence Livermore Lab.
FUSION POWER AND THE ENVIRONMENT
J. P. Holdren, T. K. Fowler, and R. F. Post 2 Jun. 1975 22 p refs Presented at the Energy and the Environ. - Cost Benefit Analysis, Atlanta, 23 Jun. 1975 Sponsored by ERDA
(UCRL-76911; Conf-750697-1) Avail: NTIS HC $4.00

Environmental characteristics of conceptual fusion-reactor systems based on magnetic confinement are examined quantitatively. Fusion, like all other energy sources, will not be completely free of environmental liabilities, but the most obvious of these--tritium leakage and activation of structural materials by neutron bombardment--are susceptible to significant reduction by ingenuity in choice of materials and design. Large fusion reactors can be designed so that worst-case releases of radioactivity owing to accident or sabotage would produce no prompt fatalities in the public. Fusion's potential environmental advantages are not entirely automatic, converting them into practical reality will require emphasis on environmental characteristics throughout the process of reactor design and engineering. Author (ERA)

N76-23719# Oak Ridge National Lab., Tenn.
DESIGN DATA AND SAFETY FEATURES OF COMMERCIAL NUCLEAR POWER PLANTS. VOLUME 4: DOCKETS 50-452 THROUGH 50-503
F. A. Heddleson Mar. 1975 159 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-55-Vol-4) Avail: NTIS HC $15.00

Design data, safety features, and site characteristics are summarized for 36 nuclear power units in 18 power stations in the United States. Data are presented for each plant consisting of thermal-hydraulic and nuclear factors, containment features, emergency-core-cooling systems, site features, circulating water system data, and miscellaneous factors. An aerial perspective is also presented for each plant. The volume covers reactors with dockets 50-452 through 50-503. Author (ERA)

N76-23720# Sandia Labs., Albuquerque, N.Mex.
INTEGRATED PHOTOVOLTAIC-THERMAL SOLAR ENERGY CONVERSION SYSTEMS
G. A. Samara 1975 11 p Presented at the Natl. Solar

Photovoltaic Program Review Meeting, Los Angeles, Calif., 22-25 Jul. 1975 Sponsored by ERDA
(SAND-75-5717; Conf-750725-1) Avail: NTIS HC $4.00

Sandia's Solar Energy Systems Computer Analysis Code (SOLSYS) is being utilized to assess the technical and economic feasibility of combined photovoltaic systems relative to various utilization scenarios. Combined systems using concentrators and high efficiency (approximately greater than 10 percent) silicon cells can provide residences (or communities) with a reasonable balance of electrical and thermal energy. The device analysis code has been used to redesign the silicon cell for high temperature, high illumination operation. A design yielding 12 percent efficiency at 50 suns and 100 C has been selected. Modified cells have been fabricated and tested. Results have confirmed code predictions. A combined collector has been built and is being tested. Thermal efficiencies greater than 50 percent at 50 suns and 100 C can be expected.
Author (ERA)

N76-23721# Sandia Labs., Albuquerque, N.Mex.
VERY LOW COST THIN FILM CdS-Cu2S SOLAR CELL DEVELOPMENT USING CHEMICAL SPRAYING
G. A. Samara 1975 24 p Sponsored by ERDA
(SAND-75-5718) Avail: NTIS HC $4.25

A chemical spray process has been developed for the production of thin film CdS-Cu2S solar cells which are projected to cost less than $60/kW in very large scale production. The average efficiency of these cells has been improved from less than 0.3 percent in 1971 to about 4.5 percent at present. The overall objectives of this program are to further develop the process, to raise the efficiency, and to attain long life stability. In the joint program Sandia Laboratories is to provide the technical support necessary to help achieve these objectives.Author (ERA)

N76-23722# Interior Dept., Washington, D.C.
REPORT TO THE CONGRESS. PROBLEMS IN IDENTIFYING, DEVELOPING, AND USING GEOTHERMAL RESOURCES
6 Mar. 1975 76 p Sponsored by ERDA
(TID-26866) Avail: NTIS HC $7.00

An assessment of the potential of geothermal resources is presented, and progress in their development as sources of energy and water is reviewed. A report of the geothermal activities and programs of the federal agencies is made in order to assist Congress in considering funding levels and priorities. The development of electrical power from geothermal resources, the geothermal leasing program, and the development of potable water from geothermal brines are discussed. ERA

N76-23723# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
LIQUID SUBSYSTEMS FOR COLLECTION, STORAGE AND DISTRIBUTION OF SOLAR HEAT
C. C. Smith, G. O. G. Loef, and D. S. Ward 30 Jun. 1975 18 p Presented at the Conf. on Appl. of Solar Energy, Huntsville, Ala.
(COO-2577-8; Conf-750351-1) Avail: NTIS HC $4.00

A solar energy system for the heating, cooling, and service hot water heating of a residential style building is described. An aqueous solution of ethylene glycol is used as the solar collection fluid, with water used for storage and load distribution. Many of the components and materials incorporated in this system are new to the building heating and cooling field. The special considerations which must be confronted in the assembly of an optimized solar heating and cooling system are discussed. Studies of the components required to efficiently transfer and store low temperature solar heat and to minimize loss of thermal availability are included. Several modes of operation permit critical comparisons of the subsystem components, materials, and engineering design. The performance of pumps, valves, and heat exchangers evaluated over a period of 8 months of operation, provides a basis for recommending specific designs, materials, and components as well as suggesting improvements in these areas.
Author (ERA)

N76-23724# California Univ., Berkeley.
CONTROL SYSTEM FOR COMBINED SOLAR HEATING AND COOLING SYSTEMS Progress Report, 21 Jun. - 31 Dec. 1974
M. Wahlig 31 Jan. 1975 71 p Prepared jointly with Pacific Gas and Elec. Co.
(Grant NSF AG-548)
(UCID-3716) Avail: NTIS HC $6.75

An electronic control system is being developed that will be inexpensive in mass production, and yet will be capable of operating a solar heating and cooling system in an optimized or near-optimized manner. A generalized experimental solar heating and cooling system is being constructed for the purpose of testing and exercising the controller. Cooling will be provided, in the experimental system, by an ammonia-water absorption air conditioner, driven with solar-heated hot water. To provide data necessary for determination of economic feasibility of solar heating and cooling systems in central and northern California, a series of solar radiation measurement stations is being established for the accumulation of solar insolation data. ERA

N76-23725# Brookhaven National Lab., Upton, N.Y.
PRELIMINARY CONCEPT ANALYSIS OF A LOW COST NON-METALLIC FLAT PLATE SOLAR ENERGY COLLECTOR
J. G. Cottingham 21 Jul. 1975 15 p Sponsored by ERDA
(BNL-20313) Avail: NTIS HC $4.00

The concept of using nonmetallic materials such as masonry, porcelain, or concrete as the thermal conducting media in the manufacture of flat plates solar energy collectors is examined and found functionally acceptable. The potential for large reduction in the cost of this component is illustrated. Author (ERA)

N76-23726# Brookhaven National Lab., Upton, N.Y.
HYDROGEN PRODUCTION BY WATER ELECTROLYSIS, METHODS FOR APPROACHING IDEAL EFFICIENCIES
G. Kissel, P. W. T. Lu, M. H. Miles, and S. Srinivasan 1975 22 p refs Presented at the IECEC, Wilmington, Del., Oct. 1975 Sponsored by ERDA
(BNL-20106; Conf-751020-1) Avail: NTIS

For hydrogen production by water electrolysis to be competitive with the conventional methods, it is necessary to operate the electrolysis cells at high current densities and at high voltage efficiencies. The methods of improving the efficiencies of water electrolysis cells examined include: (a) maximization of real to apparent surface area of electrodes to reduce activation overpotential, (b) increase of operating temperature to reduce activation and ohmic overpotential losses, and (c) reduce the thickness between electrodes to decrease the ohmic drop in the cell. Results are presented. Author (ERA)

N76-23727# Argonne National Lab., Ill.
SOLAR ENERGY IN PROVIDING FOR ALTERNATE LIFE-STYLES
J. H. Martin 30 Jul. 1975 21 p refs Presented at the Ann. Meeting of the Intern. Solar Energy Soc., Los Angeles, 28 Jul. - 1 Aug. 1975
(Contract W-31-109-eng-38)
(CONF-750712-6) Avail: NTIS HC $4.25

Exploitation of cheap and abundant reservoirs of fossil fuels has permitted some cultures to develop a lifestyle and standard of living which depletes natural resources. To reduce the severity of this draw-down, a concept was developed which combines the best of modern technology and the experience of more primitive societies in producing a residential option which is low in environmental impact as well as aesthetically attractive. An educational demonstration of this residential concept is to be developed on a six-acre plot twenty-five miles southwest of Chicago. The design and usage features are described which enable the occupants to collect all their residential energy from the sun, to receive all their water from natural rainfall, and to recycle their wastes for return to a horticultural plot which will provide most of their food. Adaptability of this concept to a variety of situations through modifications or abbreviations is considered. Author (ERA)

N76-23728# Argonne National Lab., Ill.
TURNING COLLECTORS, A COMPROMISE BETWEEN STATIONARY AND HELIOSTATIC ONES
A. Z. Barak 1975 20 p refs Presented at the Ann. Meeting of the Intern. Solar Energy Soc., Los Angeles Sponsored by

ERDA Prepared jointly with Israel Desalination Eng. Ltd.
(CONF-750712-5) Avail: NTIS HC $4.00

A turning collector is defined as one which tracks the sun very crudely, stepwise, having two or three positions during the day. It is turned around an axis which is essentially parallel to the polar one. Its morning position is about 30 deg (10 deg to 50 deg) east of the longitude, its afternoon position is about the same angle west of the longitude, and its noon position for a three-position collector is approximately facing the equatorial direction. The turning operation may be effected manually or automatically; either by simple solar energized devices (such as a pair of Nitinol or bimetal elements), or by a more conventional mechanism. Turning collectors have qualitatively the same advantages and most of the disadvantages of tracking collectors. Author (ERA)

N76-23729# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Progress Report, 1 Jan. - 31 Jul. 1975
31 Jul. 1975 180 p refs Prepared jointly with Spectrolab, Inc., Sylmar, Calif.
(Contract E(11-1)-2590)
(COO-2590-1) Avail: NTIS HC $12.00

Analytical modeling of silicon solar cells under high illumination was completed and it appears they can be designed to operate at over 100 suns with conventional processing and with characteristics comparable with conventional space cells. Cells are currently being fabricated which are optimized for various intensities for testing in a single cell concentrator simulator and for four system tests. Evaluation of various concentrator systems under actual weather conditions were completed for the 20 locations on the Aerospace data tapes. Even at the location of the lowest direct insolation (Omaha), several of the concentrator systems collected more energy than flat, fixed tilted arrays. Surface accuracy, off-axis tracking, and packing factor optimization analysis were started. System cost studies were extended to additional concentration systems and for comparisons of silicon and GaAs cells. Author (ERA)

N76-23730# Aerojet Nuclear Co., Idaho Falls, Idaho. National Engineering Lab.
REVIEW AND TENTATIVE SELECTION OF A WORKING FLUID FOR USE WITH A MEDIUM TEMPERATURE (300 F) GEOTHERMAL RESOURCE
J. F. Whitbeck Jul. 1975 19 p refs
(Contract E(10-1)-1375)
(ANCR-1224) Avail: NTIS HC $4.00

A review of conventional refrigerants was made to determine the best fluid to be used as the working fluid in an electrical power plant application where energy will be derived from a medium temperature geothermal heat source. Major considerations were operating pressures, operational flexibility, thermal efficiency, line sizes, and potential for best utilization of the geothermal heat source. Isobutane was selected as the best working fluid for a 300 F geothermal fluid application. Its acceptability for the lower temperatures indicated the general utility of this fluid for power plant applications over a significant temperature range. In an effort to obtain maximum utilization of the geothermal fluid, a dual boiling cycle was selected as the reference cycle for preliminary study and a basis for future comparative analysis. Author (ERA)

N76-23731# Aerojet Nuclear Co., Idaho Falls, Idaho.
GEOLOGICAL ASPECTS OF AN ASSESSMENT OF THE NATIONAL POTENTIAL FOR NON-ELECTRICAL UTILIZATION OF GEOTHERMMAL RESOURCES
K. M. Hollenbaugh and C. R. Nichols Jun. 1975 251 p refs
(Contract AT(10-1)-1505)
(ANCR-1213) Avail: NTIS HC $7.60

Data are presented on the potential sources and uses of geothermal water particularly in the Western third of the United States. These data include the currently known or expected location, quality, quantity, and temperatures of geothermal sources. Recommendations are made relative to potential utilization of these sources. In addition, suggestions are presented for the scientific evaluation of these and other potential geothermal sources. Author (ERA)

N76-23732# American Astronautical Society, Tarzana, Calif.
TEMPERATURE CONTROL FOR SOLAR HEATING AND COOLING OF BUILDINGS
C. B. Winn and D. Hull 1975 36 p refs Presented at the 66th Ann. Conf. of Intern. District Heating Assoc., Skytop, Pa., 23 Jun. 1975 Sponsored in part by ERDA and NSF
(AAS-75-105; Conf-750739-1) Avail: NTIS HC $5.00

A control system presently being employed in existing solar energy buildings is presented. This controller is then discussed in terms of the development of control systems that allow the user to regulate the amount of solar and auxiliary supplied energy in the thermal control of buildings, the development of control systems that respond to variations in the use patterns of buildings on seasonal, daily, hourly, and instantaneous bases, and the development of controls based on algorithms that minimize the total use of energy in heating and cooling buildings. Several heuristic control strategies are considered and examined in terms of their performance. Finally, a discussion of optimal control strategies is presented and compared with the controllers previously examined. Author (ERA)

N76-23733# Argonne National Lab., Ill.
REGIONAL ENERGY MODELING: AN EVALUATION OF ALTERNATIVE APPROACHES
A. S. Cohen and K. W. Costello Jun. 1975 148 p refs Sponsored by ERDA
(ANL/AA-1) Avail: NTIS HC $5.45

Eight comprehensive energy models, representing the current state of the art, are evaluated and their ability to analyze present energy issues is discussed. Initially, the criteria on which the evaluations are based are defined and, in the process, a conceptual model that contains the essential characteristics of a regional energy model is generated. Each of the models is evaluated individually and the modeling techniques used are compared. The models are categorized into local impact and national synthesis groups. The impact group can be applied to state or substate areas. Their forte is the degree of the end-use detail they provide. The national synthesis models are designed to analyze the impacts of national policies on the availability and/or consumption of energy on a national or regional basis. Recommendations for future research and model development are presented. The primary goal of these future research efforts is to alleviate the shortcomings of existing techniques. Author (ERA)

N76-23734# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
PERSPECTIVES IN ENERGY REQUIREMENTS OF MANKIND
J. L. Symonds Aug. 1975 34 p refs
(AAEC/IP-2) Avail: ERDA Depository Libraries HC $4.75

The growth of energy demand from the nineteenth century to the present and its likely future development are described, for the interested layman, in the context of the changing pattern of resource use. The availability and distribution of the renewable and nonrenewable resources of energy, which will provide for the future, show that developed and developing countries will incur supply problems in the decades ahead unless the potential of all energy reserves is tapped. Factors such as the market penetration of new resources and the depletion of resources are outlined. It is pointed out that coal may be used increasingly for some time, but nuclear energy is the only other energy form that is immediately available and that can be utilized commercially. Nuclear energy will be needed even if countries are prepared to cut back to low growth rates in energy use. It is suggested that lower growth rates may well be necessary in the next twenty to thirty years, since it takes this time to bring new alternative technologies into commercial use, and a further similar period will be required to achieve significant resource substitution. Author (ERA)

N76-23735# Brookhaven National Lab., Upton, N.Y.
METHODOLOGY OF TECHNOLOGY ANALYSIS WITH APPLICATION TO ENERGY ASSESSMENT
K. C. Hoffman 1975 25 p refs Presented at the Ann. Meeting of ASME, Houston, Tex., 30 Nov. 1975

(BNL-20083; Conf-751106-12) Avail: NTIS HC $4.25

In view of the significant social and economic consequences of technical change, it is important for the engineering community to provide sound technical inputs to the formulation of national policies. A methodology designed specifically for this purpose for application to large-scale technical systems is described and illustrated by application to the U. S. energy system. This methology, Technology Analysis, uses three basic building blocks: a structural description of the system, and optimization technique for system synthesis and design, and a model of the economy within which technical detail and social structure may be expressed. The approach is general and is adaptable to other important technology policy areas including materials, agriculture, and transportation. Author (ERA)

N76-23736# Energy Research and Development Administration, Washington, D.C. Div. of Geothermal Energy.

DEFINITION REPORT: GEOTHERMAL ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM

Oct. 1975 76 p refs

(ERDA-86) Avail: NTIS HC $5.45

A broad definition of Geothermal Energy RD and D Program involving the activities of ERDA and other cognizant Federal agencies is given. The goal of this program is to work with industry to provide the nation with an acceptable option which, if exercised, would permit the timely exploitation of our geothermal resources. Federal efforts which will assist industry in accelerating geothermal development are defined in the areas of resource assessment; research, development and demonstration in areas of high technical risk; information dissemination and loan guaranties to reduce financial risk; and assistance in the reduction and removal of institutional impediments to healthy industrial growth. Program planning for this Geothermal Energy Research, Development and Demonstration (RD and D) Program was carried out as a coordinated interagency effort and within the overall framework of the National Plan for Energy RD and D. ERA

N76-23737# Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.

ENERGY MODELS FOR ENVIRONMENT, POWER, AND SOCIETY

H. T. Odum and C. Kylstra 1975 376 p refs

(Contract AT(40-1)-4398)

(ORO-4398-3) Avail: NTIS HC $11.75

This is an annual report and also a general contract summary of work on the energy models, concepts, and simulations for understanding the systems of environment, power, and society. Included is a general narrative of project work, summary of development of energy language and application of its models, simulation of systems of city and county size, development of net energy and energy quality theory, use of models and net energy theory to evaluate aspects of national policy, and aspects of interface between project work and national and state policy makers. Results this year include modeling and simulation of energy basis for Miami, Florida; net energy of coal, oil shale, solar water heating, and present nuclear power plants; and papers written on the theories of energy quality, energy theory of value, and investment ratio for estimating economic viability. A separate abstract was prepared for each of ten major sections. ERA

N76-23738# Oak Ridge National Lab., Tenn.

MIUS TECHNOLOGY EVALUATION: THERMAL ENERGY STORAGE MATERIALS AND DEVICES, AUGUST 1975

C. L. Segaser Nov. 1975 65 p refs

(Contract W-7405-eng-26)

(ORNL-HUD-MIUS-23) Avail: NTIS HC $5.45

The technologies relevant to the design of thermal energy storage (TES) devices and the selection of TES materials for application in a modular integrated utility system (MIUS) are evaluated. Several thermal energy storage materials are commercially available in large quantities, are relatively inexpensive, and have properties which make them suitable for use in a MIUS. The techniques for thermal energy storage may involve the sensible heat of water or one of the available nonporous solids, or the latent heat of fusion of one of the available phase-change materials (PCMs). The conclusion is that water is a logical choice for thermal energy storage in a MIUS. This choice is based partly on the fact that water is a low-cost material. Also, because water is the most likely thermal energy conveyance medium between a MIUS district heating and cooling plant and the point of use, the TES containment unit can be a simple large district storage tank that does not require an intermediate heat exchanger. Author (ERA)

N76-23739# Oak Ridge National Lab., Tenn.

ELECTRICITY DEMAND BY MANUFACTURING INDUSTRIES IN THE UNITED STATES

W. S. Chern Nov. 1975 74 p refs

(Contract W-7405-eng-26)

(ORNL-NSF-EP-87) Avail: NTIS HC $5.45

The important trends are examined related to the manufacturing consumption of electricity and to estimating the demand relationships for groups of and selected individual manufacturing industries. Emphasis is on the estimation of price response, interfuel substitution, and the impact of technological change. Sixteen major manufacturing industries at the Standard Industrial Classification three-digit level were selected for analysis. It is shown that industrial demand for electricity is price elastic in the long run. Furthermore, natural gas, oil, and coal were found to be significant substitutes for electricity. However, the pattern of the interfuel substitution varies from industry to industry. The results also show that technological progress has reduced the manufacturing usage of electricity at an annual rate of 1.2%, while ignoring other factors over 1958-1971. Author (ERA)

N76-23740# Oak Ridge National Lab., Tenn.

ELECTRICITY DEMAND: PROJECT INDEPENDENCE AND THE CLEAN AIR ACT

L. D. Chapman, G. G. Akland, J. F. Finklea, R. I. Larsen, T. D. Mount, W. C. Nelson, D. C. Quigley, and W. C. Wilson Nov. 1975 69 p refs

(Contract W-7405-eng-26)

(ORNL-NSF-EP-89) Avail: NTIS HC $5.45

Policy issues facing electric utilities, consumers, and Federal and state agencies were analyzed. Conclusions are: (1) Demand growth should proceed at a lesser rate than in the past. The 1980 consumption may be 2.2 trillion kWh, rather than the 3.1 trillion kWh projected by the Natural Electric Reliability Councils. (2) Conservation programs should be continued and expanded, and applied to every jurisdiction level and consumer group. (3) Natural gas use should be promoted for home and business heating where possible. Natural gas use in power generation and (in general) in industrial boilers is less desirable. The expansion of home and office electric resistance heating should be discouraged. (4) Rate structures should not be inverted, but rate increases should be passed along to consumers to reduce average price differences within classes and between classes. (5) The primary ambient air quality standards in the Clean Air Act should be implemented. Author (ERA)

N76-23741# Sandia Labs., Albuquerque, N.Mex.

LOW COST SOLAR AUGMENTED HEAT PUMP SYSTEM FOR RESIDENTIAL HEATING AND COOLING

J. M. Alcone 1975 28 p refs Presented at the Ann. Meeting of ASME, Houston

(SAND-75-5272; Conf-751106-11) Avail: NTIS HC $4.50

The analysis and design of a low cost solar collector/heat storage system configured to take advantage of the characteristics of conventional air-to-air heat pumps is presented. The dynamical interaction of the various system components is examined and the resulting design constraints are given. The system as proposed eliminates the collector costs associated with conventional solar systems while requiring an increase in the volume required for thermal storage of 50 percent. Author (ERA)

N76-23742# Institute for Water Resources, Fort Belvoir, Va.

HYDROELECTRIC POWER POTENTIAL AT CORPS OF ENGINEERS PROJECTS Final report

Ralph L. Trisko, Amichai Gilead, G. P. Johnson, and Brion Sasaki Jul. 1975 345 p refs

(AD-A018359; IWR-RR-75-R1) Avail: NTIS CSCL 10/2

This study is intended as a broad framework within which the Corps of Engineers might conduct detailed studies at the project level of hydropower potential at Corps projects and on streams susceptible of development by the Corps. It assembles

and analyzes data on U. S. undeveloped hydropower potential; fossil fuel and other energy resources and consumption, costs of electricity generation; Federal hydropower policy, organization, and marketing; Federal project evaluation; economic and environmental considerations; and potential fossil fuel conservation. GRA

N76-23743# Research Triangle Inst., Research Triangle Park, N.C.
RANN UTILIZATION EXPERIENCE. CASE STUDY NO. 19: SOLVENT-REFINED COAL
Z. L. Taylor 1975 22 p Prepared in cooperation with Auburn Univ.
(Contract NSF C-927)
(PB-247262/9; NSF/RA/G-75-047) Avail: NTIS HC $3.50 Also included in complete report and summary as PB-247243, HC $13.00 CSCL 21D

Coal, America's most abundant and available natural fuel source, can contribute significantly to supplying the nation's increasing demand for fuels if improved extraction and refining technologies can be developed that meet anti-pollution requirements. This project investigated one process for coal gasification and liquefaction. The primary product of the solvent-refined coal (SRC) process is a solid fuel from which the impurities and inflammable materials have been removed. The report briefly reviews use of the research results. GRA

N76-23744# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE. A SUMMARY
Nov. 1974 115 p
(PB-248491/3; FEA/N-74/531) Avail: NTIS HC $5.50 CSCL 05C

The Nation's energy problem is evaluated. The broad strategic options available to the U.S. are considered along with strategies in terms of their impact on: development of alternative energy sources; vulnerability to import disruptions; economic growth, inflation and unemployment; environmental effects; regional and social impacts. An analytical and factual basis for focusing debate on the difficult choices and tradeoffs, and selecting a national energy policy is provided. GRA

N76-23745# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE REPORT
Nov. 1974 788 p
(PB-248492/1; FEA/N-74/532) Avail: NTIS HC $18.75 CSCL 10A

The base case situation through 1985 is assessed if current policies prevail; and the impacts and implications are evaluated of a wide range of major energy policy alternatives which should be considered as ways to eliminate imports. Policy alternatives are weighed in terms of vulnerability to supply disruptions, economic and social impacts, environmental effects, and regional differences. The broad strategic options available to the U.S. are compared. These include increasing domestic supply, conserving and managing energy demand, and establishing standby emergency programs. GRA

N76-23746# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. ANALYSIS OF REQUIREMENTS AND CONSTRAINTS ON THE TRANSPORT OF ENERGY MATERIALS, VOLUME 1 Final Report
Nov. 1974 389 p
(PB-248493/9; FEA/N-74/533-Vol-1) Avail: NTIS HC $10.75 CSCL 21D

The degree to which transportation may be a constraint on the attainment of the goals of Project Independence and the effectiveness of various governmental policies in lifting any constraints are considered. The development of new energy sources and the change in the manner of use of old energy sources that must take place in order to transport such materials as coal, gas, petroleum and products from the source to intermediate processing and thence to the end use consumer is analyzed. Four primary modes of transportation are considered: truck, rail, waterway and pipeline. GRA

N76-23747# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. AVAILABILITIES, REQUIREMENTS, AND CONSTRAINTS ON MATERIALS, EQUIPMENT, AND CONSTRUCTION Final Report
Nov. 1974 483 p
(PB-248496/2; FEA/N-74/534) Avail: NTIS HC $12.50 CSCL 13C

This report identifies and measures gaps between available and required quantities of materials, equipment, and construction that might constrain specific levels of increased energy production in the United States. It covers the energy-production process from exploration through final distribution in useable form. Eight categories considered to pose potential problems are studied. These are steel, drilling rigs, steam turbines, walking draglines, oil country tubular goods, nuclear steam supply systems, casting and forgings, and alloying metals. GRA

N76-23748# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. ENERGY CONSERVATION IN THE MANUFACTURING SECTOR 1954 - 1990, VOLUME 3 Final Report
Nov. 1974 475 p refs
(PB-248495/4; FEA/N-74/536) Avail: NTIS HC $12.00 CSCL 10A

The extent to which the manufacturing sector will economize in its use of scarce energy resources is estimated. Six industries are the primary focus of the report and include: paper and allied products; chemicals and allied products; stone, clay, glass, hydraulic cement, and glass containers; primary metals; and food and kindred products. GRA

N76-23749# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. FACILITIES Final Report
Nov. 1974 597 p
(PB-248498/8; FEA/N-74/537) Avail: NTIS HC $13.75 CSCL 10A

Oil refineries, natural gas processing plants, deep-water port facilities, fossil fueled electric power generation plants, electric power transmission and distribution systems, and the potential for conversion of current or projected oil-fired electric generation plants to coal are discussed. The national capability for hydroelectric power generation is estimated to develop formulas which could be used to represent the national or regional cost of delivered electric power taking into account alternative mixes. Alternative electric power generation and transmission costs are assessed taking into account alternative fuel mixes and site locations involving either greater transport of raw fuel or greater transmission of electric power. GRA

N76-23750# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. FINANCE: FINANCING PROJECT INDEPENDENCE, FINANCING REQUIREMENTS OF THE ENERGY INDUSTRIES, AND CAPITAL NEEDS AND POLICY CHOICES IN THE ENERGY INDUSTRIES Final Report
Nov. 1974 306 p
(PB-248499/6; FEA/N-74/538) Avail: NTIS HC $9.75 CSCL 05C

The nation's financial capacity to support Project Independence and the impact of the anticipated energy investments upon financial markets are analyzed. The 1975-90 external financing requirements of the principal energy-producing industries as implied by the investment and income projections for specific fuels, based on inputs available as of September 12, 1974 are examined. Estimates of capital investments required for new productive capacity by the energy industries from 1974 to 1990 are summarized. GRA

N76-23751# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. GEOTHERMAL ENERGY Final Report
Nov. 1974 125 p
(PB-248500/1; FEA/N-74/539) Avail: NTIS HC $5.50 CSCL 08G

The potential production capabilities of the geothermal industry and the resources necessary to achieve these levels of production are analyzed. Resources exploration and assessment, environmental, legal and institutional research, resource utiliza-

tion projects, and advanced research and technology efforts are considered. The analysis considers constraints inhibiting rapid and widespread utilization of geothermal energy, such as technological, environmental, regulatory and legal, resource and institutional constraints; and discusses accelerated supply projections. GRA

N76-23752# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. AN HISTORICAL PERSPECTIVE Final Report
Nov. 1974 51 p
(PB-248501/9; FEA/N-74/540) Avail: NTIS HC $4.50 CSCL 10A

An historical perspective to the Project Independence Blueprint is presented that traces the history of the various major energy sources and examines the reserves, consumption, technology, economics, and government policy towards oil, coal, natural gas, nuclear energy, electric power, and energy sources. The first two sections, Historical Perspective of World Energy and U.S. Energy Perspective, deal with major trends and events influencing all energy sources. Emphasis is on the period from the end of World War II to the eve of the Arab oil embargo. Government policies which have shaped the development of energy production and consumption are stressed. GRA

N76-23753# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. INPUTS TO THE PROJECT INDEPENDENCE EVALUATION SYSTEM INTEGRATION MODEL FOR THE TRANSPORT OF ENERGY MATERIALS, VOLUME 2 Final Report
Nov. 1974 228 p
(PB-248494/7; FEA/N-74/541) Avail: NTIS HC $8.00 CSCL 21D

Various methods of transporting energy materials are examined. Specific topics addressed include: transportation of coal by rail; coal transport via waterways; transport of oil and gas by pipeline; inland and coastal transport of petroleum; and the methodology used in developing coal slurry pipeline data. Resource requirements, cost estimates, and environment effects are considered. Author

N76-23754# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT, LABOR REPORT Final Report
Nov. 1974 194 p refs
(PB-248502/7; FEA/N-74/542) Avail: NTIS HC $7.50 CSCL 05A

The report analyzes the future supply of labor with specific occupational skills and compares the availability to labor requirements for increased energy production. The results of the study were used, along with other analyses, to develop the Project Independence Blueprint. The report contains four major sections: an introduction; labor in the energy sector 1960-73; labor requirements for Project Independence; and labor policy alternatives. GRA

N76-23755# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT, NATURAL GAS Final Report
Nov. 1974 242 p
(PB-248503/5; FEA/N-74/543) Avail: NTIS HC $8.00 CSCL 10A

The final technical analysis is reported of the Project Independence Interagency Natural Gas Task Force chaired by the Federal Power Commission. The task force was formed in April 1974 to provide estimates of the potential production capabilities of the natural gas industry and the resources necessary to achieve these levels of production. The task force evaluated two alternative strategies. The first was business-as-usual, which assumed the continuation of all current policies that could affect levels of production. The second strategy, accelerated demand, assumed selected changes in policies or practices that would permit a greater expansion of potential production. The report considers what could occur with respect to nonassociated natural gas from domestic sources during the period 1974 through 1990. Estimates were based on the following data: production data, price and cost data, and resource input data. Also considered in respect to increased natural gas production were environmental considerations and impacts and production constraints. GRA

N76-23756# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. NUCLEAR ENERGY Final Report
Nov. 1974 477 p
(PB-248504/3; FEA/N-74/544) Avail: NTIS HC $12.50 CSCL 10A

The final technical analysis is presented of the Project Independence Interagency Nuclear Task Force chaired by the Atomic Energy Commission. The task force was formed to provide estimates for the Project Independence Blueprint of the potential production capabilities of the nuclear industry and the resources necessary to achieve these levels of production. The task force evaluated several alternative strategies which assumed various levels of potential production. Topical discussions of the major resources required to achieve the projected production levels as well as subjects associated with nuclear power generation are discussed. GRA

N76-23757# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. OIL: POSSIBLE LEVELS OF FUTURE PRODUCTION Final Report
Nov. 1974 169 p refs
(PB-248505/0; FEA/N-74/545) Avail: NTIS HC $6.75 CSCL 08I

Estimates are presented to provide for the potential production capabilities of the oil industry and the resources necessary to achieve these levels of production. The possible levels of future production of petroleum liquids from domestic sources are outlined and how much domestic production would result at various price levels under a continuation of pre-1973 policies and, alternatively, under policies modified to give maximum encouragement to domestic oil production is estimated. Requirements for capital, equipment, materials, and personnel are also estimated. GRA

N76-23758# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. POTENTIAL FUTURE ROLE OF OIL SHALE, PROSPECTS AND CONSTRAINTS Final Report
Nov. 1974 834 p
(PB-248506/8; FEA/N-74/546) Avail: NTIS HC $21.25 CSCL 08I

The prospects are examined for expanding shale oil production to meet the objectives of Project Independence. Production potential; resource requirements such as human, money, and material resources; production constraints; and actions needed to accelerate development are considered. Economic factors in increased development of oil shale production; oil shale resource base and ownership; leasing requirements and policy; water demand, supply and quality; air quality analysis, impact on fish and wildlife, and the status of technology are discussed. GRA

N76-23759# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. PROJECT INDEPENDENCE AND ENERGY CONSERVATION. TRANSPORTATION SECTORS, VOLUME 2 Final Report
Nov. 1974 262 p
(PB-248509/2; FEA/N-74/547) Avail: NTIS HC $9.00 CSCL 21D

The impact of increased fuel prices on fuel consumption and the potential for energy conservation in transportation in the U.S. in the years 1980, 1985 and 1990 were investigated. All passenger and freight transportation is included in the study. The report contains five parts plus a summary. The introduction sets forth the key economic and policy assumptions of the study. Part 2 presents the data, analysis and projections for the passenger modes. Part 3 does the same for the freight modes. Part 4 includes a regional breakdown of the consumption of several key fuels. Part 5 analyzes the implications of price changes in crude oil and petroleum products on the demand for freight transportation. The summary provides an overview of the total

study and presents summary data on transportation and energy consumption. GRA

N76-23760# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT, SOLAR ENERGY Final Report
Nov. 1974 565 p
(PB-248507/6; FEA/N-75/548) Avail: NTIS HC $13.50 CSCL 10A

The widespread, domestic, long-term, reliable availability of solar energy resources, and the general environmental acceptability of solar energy power systems is considered. The types of solar energy research, technology development, and system implementation needed to help meet the objectives of Project Independence are outlined. It is concluded that economically viable solar energy conversion systems can be developed and installed in substantial numbers well before the year 2000 to provide significant quantities of energy and power for the U.S. Six technically feasible solar energy technologies are described for heating and cooling buildings, providing high temperature heat, and producing electric power or clean fuels. GRA

N76-23761# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. RESIDENTIAL AND COMMERCIAL ENERGY USE PATTERNS 1970 - 1990, VOLUME 1 Final Report
Nov. 1974 305 p refs
(PB-248508/4; FEA/N-74/549) Avail: NTIS HC $9.75 CSCL 10A

The foundation is established for energy policy in the residential and commercial sectors of the economy. The present levels of consumption in the two sectors, the projected growth of this consumption under several energy price assumptions, and the potential for reducing this growth by various means are explained in detail. Some of the findings include the following: of the energy consumed at present in the combined sectors, 75 percent is attributable to residential use and 70 percent is used for space heating; the projected growth at high levels of energy consumption in the combined sectors is at the rate of 2.3 percent per year. GRA

N76-23762# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT, SYNTHETIC FUELS FROM COAL Final Report
Nov. 1974 358 p
(PB-248510/0; FEA/N-74/550) Avail: NTIS HC $10.50 CSCL 21D

Estimates are given of the potential production capabilities of the synthetic fuels industry and the resources necessary to achieve these levels of production. An additional section on the impact of plant operations discusses environment, nature and source of pollutants from coal conversion process, operating personnel safety and health, social impact anticipated from the urbanization of rural areas, the political impact of plant operations, local economic impact of plant construction and operation, and the financial impact of plant operation. Technological aspects of the coal conversion process and an economic analysis of unit product costs are described. GRA

N76-23763# Federal Energy Administration, Washington, D.C.
PROJECT INDEPENDENCE BLUEPRINT. TASK FORCE REPORT. WATER REQUIREMENTS, AVAILABILITIES, CONTSTRAINTS, AND RECOMMENDED FEDERAL ACTIONS Final Report
Nov. 1974 130 p
(PB-248511/8; FEA/N-74/564) Avail: NTIS HC $6.00 CSCL 10A

The degree to which the water resources of the United States will be able to accommodate increases in energy production is examined. Factors considered include: the competition of energy-related water requirements with existing or anticipated future water uses; accommodation of energy-related water requirements with other competing uses; the magnitude of any water supply shortages, water quality, institutional and other water supply problems on future energy development scenarios; water-related federal actions required to overcome problems, requirements placed on hydroelectric power generation capability to assist in meeting the nation's energy needs. GRA

N76-23764# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
LONG WET STAND SILVER OXIDE-ZINC CELL TESTS (PHASE 1) Interim Report, Jul. 1971 - Jun. 1975
Michael P. Dougherty Sep. 1975 31 p
(AF Proj. 3145)
(AD-A018246; AFAPL-TR-75-72) Avail: NTIS CSCL 10/3

Specially built twenty ampere-hour, silver oxide-zinc cells were stored wet and charged at different temperatures for up to two years to determine capacity retention as a function of storage time and separator material. A total of 505 cells were fabricated using two to four layers of RAI P-2291 (40/60) or four layers of Fibrous Sausage Casing (FSC) as the separator material. Prior to storage, the cells were electrically conditioned and their capacities measured. Cells with each type of separator were then stored at 70F, 115F, and 150F and their capacities checked periodically. GRA

N76-23765*# New Mexico Univ., Albuquerque. Technology Application Center.
WIND ENERGY UTILIZATION, A BIBLIOGRAPHY WITH ABSTRACTS. CUMULATIVE VOLUME, 1944/1974
Apr. 1975 491 p Sponsored by NASA, ERDA and NSF
(NASA-CR-147342; PB-247970/7; TAC-W-75-700; NSF/RA/N-75-061) Copyright. Avail: NTIS HC $10.00/MF $10.00 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 10B

An energy information base which covers the broad spectrum of the energy field was developed. Wind information from throughout the world was retrieved and evaluated to compile this bibliography. The bibliography substantiates that much of wind research, as it relates to energy considerations, was accomplished early in this century, and that much research is yet to be done. GRA

N76-23330* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER MODELING OF A SINGLE-STAGE LITHIUM BROMIDE/WATER ABSORPTION REFRIGERATION UNIT
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1976 p 247-257 refs (For availability see N76-23304 14-12) CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-23766 British Library Lending Div., Boston Spa (England).
THE PHOTOMETRICAL METHOD OF MEASURING SMALL CONCENTRATIONS OF FINE DUST IN JETS OF AIR
R. M. Kaplan Dec. 1975 14 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 23, no. 6, 1953 p 1006-1013 (BLL-RTS-9799) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

A photometrical-sedimentation method is proposed for defining small concentrations of fine dust dispersed contained in air jets. The photometer includes chambers for the transillumination of dust on glass plates using a bulb supplied from an accumulator. The light passes through a condenser, the dusty plates and the lens hood, then falls on a selenium photocell. The photometer also contains a special lever-type potentiometer consisting of three decades of resistors with rheostats to balance the flow. A dry battery is used to feed the auxiliary circuit of the potentiometer. A mirror galvanometer with a reading device is also included. D.M.L.

N76-23767 Tennessee Univ., Knoxville.
APPLICATION OF DIFFUSION MODELS IN THE DESIGN OF MONITORING SURVEYS FOR AIR QUALITY ASSESSMENT Ph.D. Thesis
Terron Lee Miller 1975 226 p
Avail: Univ. Microfilms Order No. 76-11072

The purpose of this investigation was to develop a methodology for designing air pollution monitoring surveys using diffusion models and sampling statistics to provide cost effective surveys which meet specific sampling objectives. A survey was designed

for validating highway line source dispersion models and conducted in Nashville, Tennessee. The survey included real-time measurements of ambient concentrations of carbon monoxide, wind speed and direction, traffic volumes, vehicle speeds, and truck mix. Correlation and regression analyses of measured pollution levels compared to those predicted by the models showed that the models tended to overpredict concentrations under parallel wind conditions and underestimate concentrations for perpendicular and oblique wind conditions. Two empirical models were developed which were independent of atmospheric stability conditions. These models show promise as predictive tools, but require testing at other sites. Dissert. Abstr.

N76-23768*# Old Dominion Univ., Norfolk, Va. School of Sciences and Health Professions.

AMBIENT ATMOSPHERIC HYDROCARBON CONTENT AS DETERMINED BY GAS CHROMATOGRAPHIC TECHNIQUES FROM RURAL TIDEWATER VIRGINIA IN LATE SPRING 1974

G. E. Copeland, R. Davis, P. Maroulis, A. R. Bandy, R. Denyszyn, and Earl C. Kindle Nov. 1975 13 p ref

(Grant NGL-47-003-067)

(NASA-CR-147922; PGSTR-AP75-14) Avail: NTIS HC $3.50 CSCL 13B

In an attempt to ascertain the naturally generated hydrocarbon contribution to the air quality of the Hampton Roads region of Tidewater Virginia, a series of 27 air samples was obtained in two rural locations during late spring of 1974. These samples were analyzed for their hydrocarbon content (carbon number range C5 to C10) using gas chromatographic techniques. The thirty different hydrocarbon species were identified and monitored in the experiment. Preliminary analysis of the data indicates an average concentration of 397 parts per billion by weight (carbon) for the total non-methane hydrocarbon loading for C5 to C10 during the experiment. This value exceeds the National Primary Air Quality Standards as set by the Environmental Protection Agency. Author

N76-23769*# Old Dominion Univ. Research Foundation, Norfolk, Va.

DATA SET FOR BACKGROUND INVESTIGATION OF ATMOSPHERIC CONSTITUENTS FOR CAPE HENRY SITE: AUGUST 5-22,1974

May 1975 48 p

(Grant NGL-47-003-067)

(NASA-CR-147925; PGSTR-AP75-08) Avail: NTIS HC $4.00 CSCL 13B

The laboratory was located within the Fort Story Military Reservation at Cape Henry between 5 August and 21 August 1974. Total sulfur, total hydrocarbons, NO, NO2, Nox, and O3 were monitored and reported as hourly averages. Visibility was measured using an integrating nephelometer and reported as hourly averages. Twenty-four hour averaged mass loading was determined using two high volume air samplers located on different levels (25' and 50') at the site. Temperature, wind speed, relative humidity, barometric pressure and solar radiation intensity were measured at the site or supplemented by readings taken by the U. S. Coast Guard at the Cape Henry Light House. Author

N76-23770*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.

INTERDISCIPLINARY STUDY OF ATMOSPHERIC PROCESSES AND CONSTITUENTS OF THE MID-ATLANTIC COASTAL REGION Annual Report

Earl C. Kindle May 1976 13 p

(Grant NGL-47-003-067)

(NASA-CR-147926; PGSTR-AP76-33) Avail: NTIS HC $3.50 CSCL 13B

Progress is reported in the following areas: analysis of the air quality of Plymouth Park, Chesapeake, Virginia; background analysis and impact assessment for the proposed expansion of Busch Gardens; application of remote sensing and atmospheric interaction; and biosphere interaction. Plans for further study are included. J.M.S.

N76-23771# California Univ., Livermore. Lawrence Livermore Lab.

AIR POLLUTION ANALYSIS

J. B. Knox Aug. 1975 20 p refs Presented at the ERDA-Wide Conf. on Computer Support on Environ. Sci. and Analysis, Albuquerque, N. Mex., 9-11 Jul. 1975 Sponsored by ERDA (UCRL-76773-Rev-1; Conf-750706-10) Avail: NTIS HC $4.00

With the formation of ERDA a focal point exists for the development of information useful to decision- and policymakers in selecting energy options and assessing the associated environmental impacts, with a view to their minimization. Air-quality analysis and assessment is perceived to play an important role in these environmental considerations that span spatial scales from the site to subcontinent. The computer-science requirements indicated for the development of analytical assessment tools for large-scale, coupled transport-kinetic problems are identified, illustrated from past experience, and summarized into salient characteristics. Author (ERA)

N76-23772# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).

MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION

R. Reiter, H. J. Kanter, and R. Sladkovic 1975 50 p refs

(Contract AT(11-1)-3425)

(COO-3425-11) Avail: NTIS HC $5.50

Progress is reported on studies of the mechanics of air mass exchange between stratosphere and troposphere. Aerosol samples are taken on a daily basis at Zugspitze peak above the boundary layer. Radionuclide concentrations are measured after completion of a chemical separation process. Transport from the point of injection in the tropopause to the measuring station is determined by isentropic trajectory analysis, using all aerological data available. A Lidar system as well as a Rawinsonde station are available for sounding the fine structure of the condition of the atmosphere near the measuring station. Using statistical methods and based upon the activity rates of the radionuclides the seasonal variations in the intensity of stratospheric-tropospheric exchange were studied and mean residence time in the lower stratosphere was determined. Interaction between solar-terrestrial events and stratospheric-tropospheric exchange was studied by statistical means. Author (ERA)

N76-23773# Joint Publications Research Service, Arlington, Va.

HOT-AEROSOL PARTICLES ASSOCIATED WITH INDUSTRIAL ATOMIC ENERGY

A. V. Bykhovskii and O. M. Zaraev 1 Feb. 1974 209 p refs Transl. into ENGLISH of the book "Goryachie Aerozolnyye Chastitsy pri Tekhnicheskom Ispolzovanii Atomnoy Energii" Moscow, Atomizdat, 1 Feb. 1974 p 1-253 Sponsored by ERDA

(ERDA-TR-65) Avail: NTIS HC $7.60

The broad range of problems associated with radiation safety in the case of contamination of the atmosphere by highly active aerosol particles is discussed. The modern concepts of radiation danger of aerosols, features of its assessment and monitoring, connected with the presence of radioactive particles in the composition of radioactive aerosol systems are presented. Also examined are the basic mechanisms by which radioactive aerosol particles are formed during the industrial utilization of atomic energy, particularly in nuclear reactors and large gamma-machines, and also during the recycling and processing of nuclear fuel. Author (ERA)

N76-23774# Oak Ridge National Lab., Tenn.

STATISTICAL ANALYSIS OF ENVIRONMENTAL DATA

J. J. Beauchamp, K. O. Bowman, and F. L. Miller, Jr. Oct. 1975 29 p

(Contract W-7405-eng-26)

(UCCND-CSD-INF-64) Avail: NTIS HC $4.00

The analyses are summarized of data from samples taken around the Browns Ferry Nuclear Plant located in Northern Alabama. The data collection was begun in 1968 and a wide variety of types of samples were gathered on a regular basis. The statistical analysis of environmental data involving very low-levels of radioactivity is discussed. Applications of computer calculations for data processing are described. ERA

N76-23775# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENT AND SAFETY. ARAC: REAL - TIME PREDICTION OF HAZARDS DUE TO RADIOACTIVE RELEASES
Aug. 1975 24 p refs
(Contract W-7405-eng-48)
(UCRL-52000-75-8) Avail: NTIS

The Atmospheric Release Advisory Capability (AEAC) is an ERDA-sponsored service designed to provide nuclear facilities with real-time predictions of the health hazards that might result from a release of radionuclides or other toxic materials. A two-laboratory feasibility study has proved the concept. LLL has built and is now operating a prototype ARAC component. ERDA plans to implement ARAC service at six of its nuclear facilities during the next three years. Author (ERA)

N76-23776# Gary Aircraft Corp., San Antonio, Tex.
ADVANCED TRICKLING FILTER FOR WASTEWATER TREATMENT Final Report, Jun. - Dec. 1974
E. W. Leschber Aug. 1975 42 p refs
(Contract F08638-74-C-0007; AF Proj. 2054)
(AD-A018318; AFCEC-TR-75-6) Avail: NTIS CSCL 13/2

A prototype advanced trickling filter unit using a foamed silica medium was designed, constructed, installed, and evaluated. The reduction in biochemical oxygen demand (BOD) and total suspended solids (TSS) were the parameters of most interest. The design hydraulic load of the unit was 700,000 gallons per day. The design organic load (BOD) was 80 pounds per 1000 cubic feet per day. The design solids load was 60 pounds per 1000 cubic feet per day. The assumed organic and solids concentrations were 40 mg/l and 40 mg/l, respectively. Laboratory data shows that the effluent BOD was reduced from 29 mg/l to 18 mg/l. The TSS reduction was from 64 mg/l to 32 mg/l. This indicates a reduction that will allow the upgrading of existing treatment plants to a level consistent with newer effluent limitations. The installation and operation of GaryGlas advanced trickling filters were economical. These filters demonstrated their effectiveness and efficiency as a wastewater treatment system. GRA

N76-23777# Lehigh Univ., Bethlehem, Pa. Engineering Lab.
BIOLOGICAL REGENERATION OF ACTIVATED CARBON IN ADVANCED WASTEWATER TREATMENT
Robert L. Johnson Jun. 1975 91 p refs
(Contract DI-14-31-0001-5038)
(PB-247298/3; LEHIGH/FL/388-2; W76-01684;
OWRT-A-032-PA(1)) Avail: NTIS HC $5.00 CSCL 13B

Enhancement of biological activity was used for off-line batch regeneration of exhausted carbon and in aerated contactors for in-situ regeneration. After three off-line batch biological regeneration cycles, the carbon capacity exceeded 1.0 lb COD/lb with no apparent reduction in the COD removal rate compared to virgin carbon. In 200 days of aerated contactor operations the apparent capacity was 1.87 lbs COD/lb carbon. The influent COD of 94.6 mg/liter was reduced to 30.4 m/liter at 1.5 gpm/sq ft with 25 minutes detention. A parallel aerated sand contactor removed over 140 lbs COD/day per 1,000 cu ft (ptcfd) at 340 ptcfd loading rate. Carbon operating costs for small physical-chemical treatment plants could be reduced 50 percent by using aerated contactors and comparable economic savings can be achieved by using the biological activity in tertiary treatment. GRA

N76-23778# Environmental Protection Agency, Philadelphia, Pa.
INSPECTION AND MAINTENANCE PROGRAM CHECKLIST Final Report
George J. Gorman, III Dec. 1975 24 p
(PB-247825/3; EPA-903/9-75-020) Avail: NTIS HC $3.50 CSCL 13B

A guide/checklist for implementing an inspection and maintenance program for motor vehicle exhaust emissions control is presented. Various laws and regulations across the United States were reviewed to provide a standard set of information on the subject. One specific use is as a checklist of items for a state to consider when writing a motor vehicle emission control law. Sources of information and suggested terminology and wording are given. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-23779 Wisconsin Univ., Madison.
ROBUST SIGNAL AVERAGING Ph.D. Thesis
Joseph Foard Gettrust 1974 100 p
Avail: Univ. Microfilms Order No. 76-2479

Tests of seismic noise recorded during a feasibility study of the Vibroseis technique for deep seismic sounding suggested that the noise was approximately Gaussian distributed. The fractional deviation of the observations from the nominal Gaussian distribution was often great enough to make parametric statistical processes invalid: a robust procedure for averaging repetitive source signals was shown to be superior to both the arithmetic (parametric) and sign (nonparametric) averaging techniques. A nonlinear algorithm based on the generalized mean algorithm for soft signal limiting was developed and applied to computer Monte Carlo tests and actual field data. The results of this investigation show that the nonlinear limiter is robust in that the output signal-to-noise ratio (SNR) is enhanced significantly when the noise distribution deviates from the assumed Gaussian distribution, and is much more efficient than nonparametric techniques when the noise is actually Gaussian. Dissert. Abstr.

N76-23780 Alaska Univ., College.
PROPAGATION AND OBSERVATIONS OF VLF EMISSIONS IN THE AURORAL ZONE Ph.D. Thesis
Rajendra Nath Srivastava 1974 177 p
Avail: Univ. Microfilms Order No. 76-10865

Very low frequency data from the two auroral zone ground stations at College (dp. lat. 64.62 N) and Bar I (dp. lat. 70.20 N) situated on the same geomagnetic meridian were analyzed. The data contained many naturally occurring very low frequency emissions called hiss and chorus in the range of a few hundred Hz to a few kHZ which were identified at the ground level both from the chart records and by aural monitoring of the magnetic tape data. Examples of events, indicating relationships of ELF VLF emissions with the manifestations of auroral substorm phenomena, were studied using all-sky camera data, magnetic and 30 MHz riometer records. Dissert. Abstr.

N76-23781 Alaska Univ., College.
FIELD-ALIGNED AND IONOSPHERIC CURRENTS Ph.D. Thesis
Fumihiko Yasuhara 1975 148 p
Avail: Univ. Microfilms Order No. 76-10864

A study is presented of the distribution of the electric current, electric potential and the electric field in the ionosphere for the observed distribution of field-aligned currents, which represents one of the most important aspects of the coupling between the ionosphere and the magnetosphere. It is shown that the poleward field-aligned current is more intense than the equatorward current, the average ratio being 2:1. In the second part, by using this result, as well as the known fact that the direction of the field-aligned contents is always reversed with respect to the noon-midnight meridian, the current continuity equation or two high conductive annular rings (simulating the auroral oval) are employed. Finally, the distributions of the ionospheric current, potential and electric field during the substorm are simulated by a series of models. Dissert. Abst.

N76-23782 New York Univ., N.Y.
DYNAMIC POROELASTICITY Ph.D. Thesis
Carlos Arturo VargasGuadarrama 1975 135 p
Avail: Univ. Microfilms Order No. 76-10235

Biot's equations of dynamic poroelasticity are studied with a view to their application to earthquake mechanisms. Derivation of these equations is outlined. Typical values of the constants appearing in the equations, which are relevant to the rock surrounding earthquake sources are given. A reciprocity theorem is proved and body-force equivalents to seismic dislocation are derived. It is shown that the body force equivalent to slip on an infinitesimal area of fault plane is the so called double-couple

force system. Finally two special problems related to earthquake sources are solved. Dissert. Abstr.

N76-23783 Cornell Univ., Ithaca, N.Y.
STUDIES OF THERMAL CONVECTION WITH APPLICATION TO CONVECTION IN THE EARTH'S MANTLE Ph.D. Thesis
Edgar M. Parmentier 1975 157 p
Avail: Univ. Microfilms Order No. 76-9554

Finite difference numerical methods are applied to several problems of finite amplitude thermal convection relevant to the study of convective motions in the earth's mantle. PART I considers the mathematical and physical formulation of the problems. Equations governing thermal convection with dissipative heating and compressibility are derived, and simplifications appropriate for convection in the earth's mantle are discussed. Numerical methods for treating thermal convection with large viscosity variations are reviewed, and several improvements to existing methods are developed. In PART II, numerical experiments of steady-state thermal convection in a cylindrical geometry which have been carried out to identify the conditions necessary for plumes to occur in the mantle are discussed. Internally and base-heated flows with both constant and variable diffusion creep viscosity are considered. These experiments show that plumes occur only for base-heated, variable viscosity flows.
Dissert. Abstr.

N76-23784*# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
STRAIN BUILDUP AND RELEASE, EARTHQUAKE PREDICTION AND SELECTION OF VLB SITES FOR THE MARGINS OF THE NORTH PACIFIC Annual Progress Report
Christopher H. Scholz and Tracy Johnson Apr. 1976 74 p refs
(Grant NGR-33-008-146)
(NASA-CR-147242) Avail: NTIS HC $4.50 CSCL 08K

Microearthquake studies of the southern section of the San Andreas fault system were conducted in order to elucidate the role of known but little studied complications in the fault system which could affect the SAFE measurement. Data reduction from microearthquake studies in Baja California, Mexico, was completed. In addition, styles of deformation on the Alpine fault in New Zealand and on the San Andreas fault were compared. Sections of these faults with comparable physical characteristics seem to deform in a similar manner, indicating that deformation style is controlled by certain fundamental relations and will continue in the future. The geology of eastern New Guinea is also discussed. Deformation in the area is proposed to be related to collision of a series of island arcs with central New Guinea, which is part of the Australian continent. Among other unusual properties, eastern New Guinea contains the highest anomaly of the gravimetrically determined geoid based on GEM 6 and surface gravity data. Author

N76-23785*# Transemantics, Inc., Washington, D.C.
PRELIMINARY RESULTS OF UHF RADIOMETRIC AND DIRECT GROUND STUDIES OF SOIL MOISTURE IN 1975, REPORT OF THE SOVIET-AMERICAN WORKING GROUP
A. Ye. Basharinov, I. M. Butenko, L. A. Parshina, Ye. A. Reutov, A. A. Chukhlantsev, and A. M. Shutko Washington NASA May 1976 20 p Transl. into ENGLISH from Predvaritel'nyye Rezul'taty SVCh radiometricheskikh i pryamykn nazemnykh issled. vlazhnosti pochv, v 1975 g. (Otchet sovetsko-amerikanskoy gruppy) (USSR), 1976 19 p
(Contract NASw-2792)
(NASA-TT-F-17053) Avail: NTIS HC $3.50 CSCL 08M

Data regarding characteristics of weather conditions, methods and certain data of ground measurements of soil parameters, UHF radiometric equipment, tasks and methods of measurements, and certain results of integrated measurements are investigated. Figures include location of measurement regions, characteristics of the state of a number of fields in the agricultural region, characteristic profiles on relative humidity, data of spatial variations in radiobrightness on the wave of 3.4 cm. Results of ground measurements of relative humidity, data of profile measurements, dependence of soil emissivity, and spectral dependence of the degree of radiobrightness decrease over the region of ground water on the Arabat spit are given. Author

N76-23786*# Kanner (Leo) Associates, Redwood City, Calif.
INFRARED RADIATION OF NITRIC OXIDE OF THE UPPER ATMOSPHERE FROM SALYUT-4 MEASUREMENTS
M. N. Markov, G. M. Grechko, A. A. Gubarev, Yu. S Ivanov, and V. S. Petrov Washington NASA May 1976 14 p refs Transl. into ENGLISH from Infrakrasnoye izlucheniye okisa azota atmosfery po izmereniyam s Salyut-4; Moscow, preprint 8, 1976 18 p
(Contract NASw-2790)
(NASA-TT-F-17015; Preprint-8) Avail: NTIS HC $3.50 CSCL 04A

An attempt was made to determine the contribution of nitric oxide to infrared radiation of the upper atmosphere. On the basis of telescopic spectrometer readings from the Salyut-4 space station, calculations were made of the intensity and altitude localization of NO radiation, approximate provision being made for solar disturbance of the geomagnetic field. Conclusions were drawn on the volume density and flux rate of NO radiation, as well as on the relative importance of nitric oxide in forming the upper atmospheric radiation regime as compared with atomic oxygen. Author

N76-23787*# Scientific Translation Service, Santa Barbara, Calif.
SUBZONES OF LEACHED AND TYPICAL CHERNOZEM SOILS
I. I. Gorbunov Washington NASA May 1976 24 p Transl. into ENGLISH from the book "Guidebook of the Soil Excusion. Eastern European Lowland. Forest-Steppes and Steppe-Zones' Moscow, Nauka Press, 1974 p 14-31
(Contract NASw-2791)
(NASA-TT-F-17024) Avail: NTIS HC $3.50 CSCL 08M

Discussion of the soils of the Tula-Kursk sector in the Central Russian uplands is presented. Micromorphological descriptions are given for forest the watershed plateau and the Central Chernozem Reservation. Areas discussed include virgin steppes, forest lands, and cultivated land. Fertility of soils for use in agriculture and use of fertilizers is discussed. Author

N76-23788*# Kanner (Leo) Associates, Redwood City, Calif.
PHYSICAL METHODS OF INVESTIGATION OF ICE AND SNOW
V. V. Bogorodskiy, ed. and V. P. Gavrilo, ed. Washington NASA May 1976 241 p refs Transl. into ENGLISH of the book "Fizicheskiye Metody Issledovaniya Lda i Snega" Leningrad, Giprometeoizdat, 1975 228 p
(Contract NASw-2790)
(NASA-TT-F-17009) Avail: NTIS HC $8.00 CSCL 08L

This collection contains material from a scientific symposium organized by the Order of Lenin Arctic and Antarctic Scientific Research Institute and the Interdepartmental Commission on the Study of the Antarctic, Earth Sciences Section, Presidium of the Academy of Sciences U.S.S.R., held in Leningrad 1-5 October 1973. The articles presented, by both Soviet and foreign scientists, reflect the results of investigations of recent years in the following areas: (1) electromagnetic methods of investigation of ice and snow; active and passive radar methods of investigation of the ice and snow cover; (2) optical methods of investigation of the ice, snow and water; (3) dynamic and static methods of investigation of the mechanical properties of ice and snow.
Author

N76-23789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAJECTORY TRACES OF CHARGED PARTICLES IN THE MAGNETOSPHERE
Masaki Ejiri Mar. 1976 64 p refs
(NASA-TM-X-71105; X-621-76-41) Avail: NTIS HC $4.50 CSCL 04A

The characteristic enhancements of ring current particles with energies of about 1 to 100 keV, associated with magnetospheric substorms, were observed by Explorer 45 around the plasmapause in the afternoon to midnight region, and showed the characteristic structure called a 'nose' in the proton spectrograms. The motion of these particles in the equatorial magnetosphere, under a recently proposed convection electric field and a dipole magnetic field is described. Approximate equations of a bounce period, a second adiabatic invariant, and a bounce-average azimuthal velocity are given with inaccuracies less than about 0.001 for

all pitch angles. The complete set of flow patterns of 90 deg pitch angle particles is also presented by means of stagnation lines through which radial drifts and/or azimuthal drifts change their directions. The particle tracings in the magnetosphere give a basic concept to explain the observed nose characteristics.
Author

N76-23790# California Univ., Livermore. Lawrence Livermore Lab.
COMPARATIVE CLIMATIC IMPACT OF INCREASED STRATOSPHERIC AEROSOL LOADING AND DECREASED SOLAR CONSTANT IN A ZONAL CLIMATE MODEL
M. C. MacCracken and G. L. Potter Apr. 1975 8 p refs Presented at the WMO/IAMAP Symp. on Long-Term Climatic Fluctuations, Norwich, England, 17-23 Aug. 1975 Sponsored by ERDA
(UCRL-76132; Conf-750818-1) Avail: NTIS HC $4.00

The second generation zonal climate model (ZAM2) was developed to study some potentially important mechanisms of climatic change. The paper presents the results of two simulations incorporating variations in climatically important parameters and a comparison with a control case climate. The first case simulates a uniform global increase of aerosol in the stratosphere comparable to peak levels occurring after the Mt. Agung volcanic eruption in 1963 (4.3 micrograms/sq cm throughout the stratosphere). The second case simulates a 3 percent reduction in solar constant, an amount slightly less than the tropospheric solar radiation reduction computed for the Agung cloud. Preliminary results using annual average solar radiation at each latitude (which is believed to underestimate the effect) show similar responses in both the temperature and the hydrologic cycle. Surface temperature decreased about 4K at the equator and 8 to 15K in polar regions. Precipitable water content decreased by more than one-quarter and mean global precipitation by about one-eighth. Author (ERA)

N76-23791# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
TRANSPORT PROCESSES AND TRACE CONSTITUENTS IN THE STRATOSPHERE Final Report, 1 May 1972 - 30 Jun. 1975
D. M. Cunnold and F. N. Alyea 1975 27 p refs
(Contract AT(11-1)-2249)
(COO-2249-4) Avail: NTIS HC $4.50

A three-dimensional dynamical-chemical model of the stratosphere has been developed. The model includes predictions not only of the dynamical structure of the stratosphere but also of atmospheric ozone. A three year integration of this model has produced seasonal and latitudinal variations of the zonal wind and of columnar ozone which are similar to those observed. Additional model calculations have included the steady state nitrogen dioxide distributions resulting from a source of 1.8 million tons/year inserted at various locations in the lower stratosphere. It is thus concluded that the most significant effect of a large fleet of SST's producing such an injection of NO2 is to deplete total atmospheric ozone by an order of 10 percent. The latitudinal structure of this ozone depletion for various source locations is compared. Author (ERA)

N76-23792# Los Alamos Scientific Lab., N.Mex.
HEAVY METHANES AS ATMOSPHERIC TRACERS
G. A. Cowan, D. G. Ott, A. Turkevich, L. Machta, G. J. Ferber, and N. R. Daly 1975 13 p refs Presented at 2d Intern. Conf. on Stable Isotopes, Oak Brook, Ill., 20 Oct. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1988; Conf-751027) Avail: NTIS HC $4.50

Because methane-21(13CD4) is essentially nonexistent in nature and should undergo isotopic exchange very slowly, it is potentially a useful nonradioactive label for tracking air motions and testing transport and diffusion models on a continential scale. In a field experiment, to demonstrate long-range detection, 84 g methane-21 released in Idaho were detected in the atmosphere at concentrations less than 2 by volume at distances from release point varying from 1,500 to almost 2,500km. The amounts of the methane-21 found at each of four stations at expected times are generally in the range calculated on the basis of simple meteorological model. Author (ERA)

N76-23793# Los Alamos Scientific Lab., N.Mex.
STRATOSPHERIC CHEMISTRY COMPUTATIONS
J. Zinn and C. D. Sutherland Sep. 1975 20 p refs
(Contract W-7405-eng-36)
(LA-6111-MS) Avail: NTIS HC $4.00

A one-dimensional time-dependent model of atmospheric photochemistry, eddy diffusion, and rainfall in the troposphere and stratosphere is described. Diurnal and seasonal changes are explicitly considered for fixed values of latitude. It is found that the computed seasonally averaged ozone column densities are in good agreement with observational data; however, the seasonal and latitude variations are not correctly predicted. The effects of nuclear explosions and stratospheric injections of NO sub x are explored. A nuclear yield of 2,700 Mt produces a computed worldwide ozone reduction of 30 percent and 1,350 Mt has the same effect if confined to one hemisphere. The ozone reduction lasts about 10 years. Author (ERA)

N76-23794# Danish Atomic Energy Commission, Risoe.
KINETIC ENERGY SPECTRUM OF ATMOSPHERIC MOTIONS IN THE PLANETARY BOUNDARY LAYER
E. L. Petersen Jan. 1975 103 p refs
(RISO-285) Avail: ERDA Depository Libraries HC $8.25

Kinetic energy spectra of the horizontal wind vector were estimated from time series measured along the Riso 123 m meteorological tower throughout ten years. Also measurements from other localities (Station Nord, Greenland, and Karlstrup, Zealand) were used. Spectra and methods are presented and discussed. Emphasis is laid on the gain in information which is achieved when the components of the wind vector are considered rather than just the wind speed. Spectral equations in the frequency domain are derived from the equations of motion. It is shown how a ratio including the Coriolis parameter, the quadrature spectrum of the components, the energy spectrum, and the frequency can be used to determine the explicit effect of the rotating of the earth on the kinetic energy spectrum. The wind structure in the boundary layer, as measured at the Riso site, and its relation to the diurnal cycle and horizontal inhomogeneities of surface temperature are investigated. The data reveal an exceptionally large turning of the wind with the height above the ground. It is shown that this feature can be given a phenomenological description by making an analog to the thermal-wind effect. Author (ERA)

N76-23795# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
SEISMIC AND ELECTROMAGNETIC TUNNEL DETECTION INVESTIGATION Final Report, Dec. 1966 - Dec. 1969
Henry F. Knauf Jul. 1975 39 p refs
(Proj. 1J6-62708-A-46206)
(AD-A018984; USAMERDC-2151) Avail: NTIS CSCL 17/10

This report describes the major areas of tunnel detection investigations conducted by USAMERDC during the period December 1966 through December 1969. A short discussion of the tunnel problem is presented, and two technical approaches, seismic and electromagnetic, are discussed. Both seismic and electromagnetic detector systems were developed and evaluation tests were conducted to determine capabilities and limitations of the devices. The nature of the problem addressed, i.e., detection of subsurface voids located in vegetative areas, does not lend itself to the successful deployment of the systems developed; however, the basis for future development has been established. Operational parameters of the systems are presented in the appendices. GRA

N76-23796# Epsilon Labs., Bedford, Mass.
BALLOON MEASUREMENTS OF STRATOSPHERIC AEROSOL SIZE DISTRIBUTION FOLLOWING A VOLCANIC DUST INCURSION Final Report, 1 Oct. 1974 - 31 Aug. 1975
Henry A. Miranda and John Dulchinos Aug. 1975 58 p refs
(Contract F19628-75-C-0004; AF Proj. 7621)
(AD-A018372; AFCRL-TR-75-0518) Avail: NTIS CSCL 04/1

Stratospheric aerosol size distribution measurements of the volcanic dust layer over Southeastern New Mexico, obtained on a balloon flight on January 21/22, 1975 several months following the Fuego volcanic eruption, are presented and discussed in preliminary fashion. Altitude profiles of all particles broken down

into a set of contiguous size ranges indicate the presence of a pronounced concentration peak in the 16-21 Km region. Above this layer a distinct plateau is seen to exist between 22 and 26 Km which appears to be absent at night. This suggests the possibility of sunlight nucleation effects occurring in this altitude regime. A sunrise nucleation experiment conducted above this plateau region at 28 Km shows no evidence of nucleation during the first 1/2 hour following local sunrise. A distinct altitude-dependent size distribution slope in the 23-27 Km region which had been observed on a series of previous flights in May of 1973, appears to have been shifted to higher altitudes (26-28 Km) and is somewhat less pronounced. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-23797 British Library Lending Div., Boston Spa (England).
ON RISING AIR CURRENTS AND THE CREATION OF HAIL AND TORNADOES
F. Vettin [1975] 15 p refs Transl. into ENGLISH from Ann. Physik Chemie. (Berlin), v. 102, 1857 p 246-255 In ENGLISH and in GERMAN
(BLL-M-23830-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The results of an experiment designed to simulate the movement of air above warm ground are used as a basis for an explanation of the development of hail. A second experiment which takes into consideration the rotation of the earth is also described and utilized to explain the origin and behavior of tornadoes. D.M.L.

N76-23798 British Library Lending Div., Boston Spa (England).
PROBLEMS AND METHODS OF LOCAL WEATHER FORECASTING
H. Malberg [1975] 24 p refs Transl. into ENGLISH from Offenbach A.M., D. Wetterd., Ann. Met. (West Ger.), no. 9, 1974 p 129-137
(BLL-M-23825-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The system for numerical weather forecastig for Berlin is reviewed. Variations in the local forecast accuracy are discussed, and recommendations for improving the forecasts are presented. F.O.S.

N76-23799 Lehigh Univ., Bethlehem, Pa.
A THREE-DIMENSIONAL STUDY OF JETS AND FREE SHEAR LAYERS IN A SEMI-BOUNDED ROTATING FLUID WITH APPLICATIONS TO THE ATMOSPHERE Ph.D. Thesis
Gerald Vincent Price 1976 347 p
Avail. Univ. Microfilm Order No. 76-10371

A jet-based model is proposed to study the dynamics of the polar front-jet system. Equations are developed to show that the potential temperature and surface pressure are sufficient to determine the state of the model atmosphere in nonorthogonal streamaxis coordinates with a normalized pressure independent variable, subject to a condition of gradient flow in the direction of the jet. Three-dimensional approximating functions are used to represent the spatial dependence of the variables, and a Galerkin technique with an Euler-backward time extrapolation scheme is used to advance the dependent variables in time. In general, the proposed streamaxis model with its simplified physics is shown to be capable of generating both surface and mid-tropospheric frontal zones which are similar in structure to the frontal zones produced in previous model studies, as well as similar to the general characteristics observed in atmospheric frontal zones. However, gradients of the variables are not as large as the extreme values observed in intense atmospheric frontal zones. Dissert. Abstr.

N76-23800 British Library Lending Div., Boston Spa (England).
CHARACTERISTICS OF INSTRUMENTS
Hideji Nakanishi [1975] 18 p refs Transl. into ENGLISH from Kishocho Kenkyu Jiho (Tokyo), vol. 26, no. 1/2, 1975 p 17-25
(BLL-M-23858-(5828.4F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Data obtained from meteorological observations, which are processed and compiled into tables and diagrams, etc., generally have great values in utilization as various types of fundamental data. These values are an accumulation of roughly two types of value; one obtained from reading instruments and the other records made by recording instruments. Meteorological phenomena vary constantly because of generally complex causes and conditions. Referring, for instance, to wind as an air flow, it never flows uniformly, but flows at a high or a low velocity while constantly varying the direction. This can be observed from the flow of smoke coming out of a chimney. Pressure also varies constantly with little fluctuation. The same can be said of other phenomena. Author

N76-23801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOSYNCHRONOUS METEOROLOGICAL SATELLITE DATA SEMINAR
Mar. 1976 138 p refs Seminar held at Greenbelt, Md., 8-9 Dec. 1975
(NASA-TM-X-71108; X-931-76-87) Avail: NTIS HC $6.00 CSCL 04B

A seminar was organized by NASA to acquaint the meteorological community with data now available, and data scheduled to be available in the future, from geosynchronous meteorological satellites. The twenty-four papers were presented in three half-day sessions in addition to tours of the Image Display and LANDSAT Processing Facilities during the afternoon of the second day. Author

N76-23802*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR NASA'S AVSSE 1 EXPERIMENT: 25 mb SOUNDING DATA AND SYNOPTIC CHARTS
Nancy F. Fucik, (Texas A and M Univ.) and Robert E. Turner Washington Mar. 1976 24 p refs
(NASA-TN-D-8155) Avail: NTIS HC $3.50 CSCL 04B

The AVSSE 1 Experiment is described and tabulated rawinsonde data at 25 mb intervals from the surface to 25 mb are presented for the 24 stations participating in the experiment. Soundings were taken between 1,200 GMT, April 27, and 1,200 GMT, April 28, 1975. The methods of data processing and accuracy are briefly discussed. Synoptic charts prepared from the data are presented, as well as an example of contact data. Author

N76-23803# Sandia Labs., Albuquerque, N.Mex.
WIND POWER CLIMATOLOGY OF THE UNITED STATES
J. W. Reed Jan. 1975 163 p Sponsored by ERDA
(SAND-74-0348) Avail: NTIS HC $7.60

All suitable data in the National Climatic Center archives, for 758 stations, were analyzed for monthly, seasonal, and annual average wind power. Results were assembled in maps with equal power (isodyn) contours to show geographic regions most suitable for wind power exploitation. An almanac of all these wind speed distributions and power data tabulations, ordered by state and region and suitable for referencing is presented. Wind speed versus height above ground relationships were examined with upper air climatologies at 85 kPa and 70 kPa pressure-altitude levels and certain micrometeorological research towers. An often-used rule-of-thumb appears adequate: that wind speed increases in proportion to the one-seventh power of height above ground. Thus, wind power increases with the three-sevenths power of height, for use in sizing designs for wind turbines and mounts. Author (ERA)

N76-23804# Naval Postgraduate School, Monterey, Calif.
A CLIMATOLOGY OF MARINE-FOG FREQUENCIES FOR THE NORTH PACIFIC OCEAN SUMMER FOG SEASON M.S. Thesis
Gary Roland Willms Sep. 1975 61 p refs
(AD-A018300) Avail: NTIS CSCL 04/2

This study continues the Naval Postgraduate School's development of a computerized program to establish climatological

marine-fog frequencies. In particular, fog related information contained in the visibility-weather group elements of the primary synoptic surface reports is segregated into 39 fog categories. Representative fog durations for each category are statistically established from North Pacific Ocean Weather Station summer-season data at Ships, P, Q, and S. Climatological frequencies over the North Pacific Ocean, 30-60N, for the months of June, July, August and September are derived from 12 years (1963-74) of OWS and transient ship observations (about three-fourths of a million reports). Comparison to previously published climatological frequencies is made. Author (GRA)

N76-23805# Naval Postgraduate School, Monterey, Calif.
USE OF THE NOAA-2 DIGITIZED SATELLITE DATA FOR DIAGNOSING MARINE FOG IN THE NORTH PACIFIC OCEAN AREA M.S. Thesis
Ronald E. Hale and Robert J. Renard Sep. 1975 92 p refs
(AD-A018329; NPS-51HL75091) Avail: NTIS CSCL 04/2

Digital NOAA-2 visual and daytime infrared satellite data and marine surface synoptic reports, North Pacific Ocean, July 1973, are computer processed and diagnosed in an attempt to develop a scheme for identifying fog over open ocean areas as a function of satellite information only. Using approximately 3,250 ship observations as ground-truth data, present and past weather, visibility, and cloud cover and type, were sorted into eleven categories and related to the satellite data observed within two hours of the ship report. Critical visual (brightness) and infrared (temperature) count values, separately and in combination, are specified for the purpose of discriminating fog from no-fog marine areas. Satellite count-value distribution for select categories are illustrated by histograms; the relative accuracies in separating fog from no fog as a function of visual and infrared count values are shown by skill-score analyses. GRA

N76-23806# Naval Postgraduate School, Monterey, Calif.
RADIATION PARAMETERIZATION FOR THE FNWC PRIMITIVE EQUATION MODEL USING DATA OVER THE OCEANS FOR 16 JUL. 1974 M.S. Thesis
Terry William Beahan Sep. 1975 125 p refs
(AD-A018325) Avail: NTIS CSCL 04/2

This study employs a radiational model, with large-scale cloud parameterization in several layers, in order to compute the absorption of solar insolation by the ocean's surface and by atmospheric layers, and to compute the planetary albedo for the FNWC primitive equation model. Solar insolation dispositions were computed on a gridpoint basis using water-vapor mass and cloud amounts. Using emissivity formulas after Sasamori, the long-wave cooling effects were calculated at the earth's surface and over the tropospheric layers, and were found to be dependent upon the cloud parameterization. FNWC data over oceanic gridpoints for 16 July 1974 were used to test two forms of the cloud parameterization. The objective was to determine the parameterization which better verified the radiational balance at the top of the atmosphere as a function of latitude as compared with satellite climatology. The smaller cloud parameterization gave the better verification. GRA

N76-23807# Naval Postgraduate School, Monterey, Calif.
FORECASTING MARINE FOG ON THE UNITED STATES USING A LINEAR DISCRIMINANT ANALYSIS APPROACH M.S. Thesis
Michael Charles McConnell, Sr. Sep. 1975 104 p refs
(AD-A018306) Avail: NTIS CSCL 04/2

The objective of this study is to develop classification equations to forecast the daily probability of occurrence of marine fog at selected locations on the west coast of the United States, using parameters easily obtainable from upper-air soundings and surface observations. In order to achieve this objective a computerized stepwise linear discriminant analysis program is extensively employed. Data input consists of surface and radiosonde observations for the five-year period 1 July 1968 to 30 June 1973 at three U.S. west coast stations, namely San Diego and Oakland, California and Quillayut, Washington. Tables showing the number of fog and no-fog cases, the classification functions, and the percentages of correct fog and no-fog discrimination are presented for each station. The most capable fog/no-fog discrimination parameters are discussed for each set of classification equations. Test results for the San Diego equations using a three-year independent data set are also shown. Author (GRA)

N76-23808# Melbourne Univ., Parkville (Australia). School of Physics.
ATMOSPHERIC STRUCTURE IN RELATION TO ANOMALOUS PROPAGATION OVER BASS STRAIT Annual Report
B. F. Whiting, I. A. Bourne, E. L. Unthank, and V. D. Hopper Jun. 1975 73 p refs
(Contract N00014-73-C-0181)
(AD-A018249) Avail: NTIS CSCL 04/2

The phenomenon of anomalous propagation, or beyond-the-horizon radio propagation, across Bass Strait in south-eastern Australia is discussed in relation to meteorological profiles measured from an instrumented aircraft. Particular attention is given to two time intervals December 14 to 19, 1974 and February 18 to 25, 1975. GRA

N76-23809# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SURFACE BASED TEMPERATURE INVERSIONS ON THE WHITE SANDS MISSILE RANGE
Dennis E. Hulse, David J. Novlan, and Mary Ann Seagraves Aug. 1975 24 p
(DA Proj. 1T6-65702-D-127)
(AD-A018522; DR-893) Avail: NTIS CSCL 04/2

Surface based temperature inversion data were extracted from daily radiosonde observations (RAOB) at White Sands Desert (WSD) and Holloman (HMS) Raob sites on the White Sands Missile Range. The total number of observations, the percent of observations with surface based inversions, the average temperature at the top and at the base of the inversion, the average temperature change of the inversion, the extreme temperature change through the inversion, the average depth of the inversion in presure and geometric height units, and the standard deviations of the average temperature and heights of the inversions were compiled and presented in both tabular and graphical form. Discussion of the monthly variations in the surface inversion along with a closer look at the diurnal change of the surface inversion is presented. GRA

N76-23810# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12814C LANCE, MISSILE NO. 3389, ROUND NO. 268 RST Meterological Data Report
Oct. 1975 37 p
(DA Proj. 1T6-65702-D-127)
(AD-A018524; DR-896) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12814C Lance, Missile Number 3389, Round Number 268 RST, are presented in tabular form. GRA

N76-23811# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12814 LANCE MISSILE NO. 2202, ROUND NO. 267 AST (21 OCTOBER 1975) Meteorological Data Report
Oct. 1975 39 p
(DA Proj. 1T6-65702-D-127)
(AD-A018557; DR-895) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12814 Lance, Missile Number 2202, Round Number 267 AST, are presented in tabular form. Author (GRA)

N76-23812# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12815A LANCE, MISSILE NO. 3251, ROUND NO. 270 RST Meteorological Data Report
13 Nov. 1975 30 p
(DA Proj. 1T6-65702-D-127)
(AD-A018523; DR-898) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12815A Lance, Missile Number 3251, Round Number 270 RST, are presented in tabular form. GRA

N76-23813# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF A FINITE ELEMENT METHOD TO THE BAROTROPIC PRIMITIVE EQUATIONS M.S. Thesis

Donald Ernest Hinsman Sep. 1975 110 p refs
(AD-A019494) Avail: NTIS CSCL 04/2

A finite element application to the baratropic primitive equations is presented including theoretical development and the model used. Analytic initial data is generated in order to verify as well as possible the accuracy of the model. A comparison of the model with similar finite difference schemes shows that this finite element method exhibits better phase speed propagation than comparable second and fourth order finite differencing and is competitive in the size of the allowable time step. GRA

N76-23814# Naval Postgraduate School, Monterey, Calif.
UPPER LEVEL BAROTROPIC INSTABILITY IN THE TROPICS M.S. Thesis
Ronnie J. Hartinger Sep. 1975 39 p refs
(AD-A019376) Avail: NTIS CSCL 04/2

The structure of barotropically unstable disturbances in the tropics was examined with a two-level quasi-geostrophic model. The forecast equations were linearized and non-dimensionalized and the most unstable mode was found numerically by use of the initial value technique. The wind profile (U sub j) + (a sub j)(U sub 0)sech squared (y/L) was used. Simple CISK type heating was introduced to determine its effects on the growth of the waves. The jet wind profile was more unstable with easterly flow than westerly flow when no heating or friction was present. When the jet profile was present only at the upper level, the ratio of the disturbance amplitude at the lower level to the disturbance amplitude at the upper level decreased toward the equator. When the heating rate was not large enough to increase the growth rate, the amplitude ratio remained small. As the heating rate becomes larger, the ratio increases to a value larger than 1. GRA

N76-23815# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
CONTROL OF SNOW AND ICE ON MISSILE FIELDS Final Report, May 1971 - Apr. 1973
L. David Minsk Oct. 1975 72 p refs
(DA Proj. 4A0-62103-A-894)
(AD-A018558; CRREL-SR-240) Avail: NTIS CSCL 04/2

The effect of snow and ice on the operation and maintenance of a subsurface missile system was investigated during the construction stage of the Grand Forks safeguard system site. Meteorological observations were made daily from 1 November to the following 30 April for the two winters 1971-72 and 1972-73, and compared with observations made at the 1st order stations of Minot and Grand Forks, North Dakota, west and east respectively of the Safeguard site. Though differences occurred, the climatic patterns at the 1st order stations were similar, and indicate that 25-40 snowstorms can be expected each winter, snowfall in a single storm may reach 11 in. each year, and 20 in. 1 year in 30. A full-scale model of a portion of the Spartan missile mound was constructed, as well as part of the double chain link security fence and plywood models of six cell covers, and snow accumulation was observed during one winter. It was concluded that accumulation would never exceed the height of a cell cover, nor would snow completely bridge the pavement between cells. However, snow could accumulate to depths approaching 5-6 ft around the security fence under extreme conditions. When a hydraulic flume for conducting model tests for snowdrift potential became available late in the investigation, major structures at two of the radar installations were investigated, and a problem identified at one location. Performance tests were conducted on 12 models of 7-8 hp walk-behind snowblowers to evaluate the three tasks of lane, obstacle, and drift clearing which could be expected on the missile field. An analysis was made of the equipment requirements for snow clearance based on an estimate of accumulation on the site. GRA

N76-23816# Air Force Weapons Lab., Kirtland AFB, N.Mex.
MODIFICATIONS TO GTE SYLVANIA THERMOSONDE FOR IMPROVED OPERATION Final Report
Carl Curatola Nov. 1975 30 p refs
(AF Proj. 3326)
(AD-A018227; AFWL-TR-75-180) Avail: NTIS CSCL 04/2

A commercially available thermosonde system, used to provide vertical atmospheric optical turbulence atmospheric refractive index coefficient profiles, has been evaluated and modified for use in an extensive program to support optical propagation experiments. The thermosonde's previous uses by the NASA Goddard Space Flight Center and the AF Avionics Laboratory revealed several system limitations which this modification eliminated. the system was modified to: (1) simplify probe replacement calibration procedure, (2) use commercially available fine wire probes which are more sensitive, easier to handle, and less expensive than factory supplied probes, (3) shift the temperature difference response of the system to the center of the range experienced in previous tests, (4) reduce the ascent rate for improved vertical resolution, (5) allow for magnetic tape recording and computer processing of data. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-23817*# Kanner (Leo) Associates, Redwood City, Calif.
COMPARISON OF RESULTS OF THE MEASUREMENTS OF THE OCEAN SURFACE TEMPERATURE MADE BY A SOVIET SCIENTIFIC RESEARCH SHIP AND AN AMERICAN ARTIFICIAL EARTH SATELLITE
E. I. Karabasheva, V. D. Pozbynin, V. E. Sklyarov, E. P. McLean, and S. J. Roman Washington NASA May 1976 38 p refs Transl. into ENGLISH of "Sravneniye rezultatov izmereniy temperatura poverkhnosti okeana, vypolnennykh sovetskim nauchno-issledovatelskim sudnom i Amerikanskim iskusstvennym sputnikom zemli" Sov. Acad. of Sci. and the Natl. Environ. Satellite Serv., 1975 38 p
(Contract NASw-2790)
(NASA-TT-F-17025) Avail: NTIS HC $4.00 CSCL 08J

The results of a comparison of North Atlantic ocean surface temperature measurements made from the Soviet research ship Akademik Kurchatov and from the American NOAA-2 environmental research satellite are presented. Ship measurements were made with the aid of thermistor, satellite measurements with the aid of radiometers (at both visible and thermal wavelengths). Ship data are organized in the form of tables and histograms, satellite data in the form of grid-type temperature maps and infrared photographs of the region of interest. Difficulties in comparing the data from both ship and satellite sources were partially resolved through the use of statistical comparison methods. Results indicate a high correlation between ship and satellite data, and that the combined utilization of research ships and satellites will increase the effectiveness of ocean-surface temperature studies. Author

N76-23818# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
ORIGINS OF THE DEEP-SEA SEDIMENTS AND THEIR VARIATIONS WITH TIME Annual Progress Report, May 1975
P. E. Biscaye May 1975 52 p
(Contract AT(11-1)-3132)
(COO-3132-20; AR-6) Avail: NTIS HC $5.75

Techniques for studying water mass mixing and sediment transport in the benthic layer of the deep sea and the effects of these processes on the continental shelf specifically in the New York Bight were studied. Results are presented for the first major combined geochemistry-physical oceanography cruise. Data on the nature of the bottom sediments are presented principally in context of their potential as sources of both radon and methane in the lower water column. Preliminary data on the nature and composition of suspended particulates also indicate potential for tracing the mechanisms of solids dispersal in the Bight. ERA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-23819 British Library Lending Div., Boston Spa (England).
CHANGE IN VARIOUS CHEMICAL AND PHYSICAL PROPERTIES OF NATURAL WATERS ON PROLONGED STORAGE
B. A. Skopintsev Jan. 1976 27 p refs Transl. into ENGLISH from Gidrokhim. Mater. (USSR), v. 17, 1950 p 108-124
(BLL-RTS-9254A) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 20 BLL photocopy coupons

Changes in various chemical and physical properties of natural waters which take place during prolonged storage in the dark under aerobic conditions were studied. Mineral derivatives of nitrogen and phosphorus increased and dissolved oxygen decreased, basically due to biochemical decomposition. The ratio of the growth in mineral N/P and the ratio of the oxygen consumed (BOD) to the nitrate nitrogen and phosphate phosphorus formed were calculated; the resulting values of oxygen equivalents were within the limits of boundary values calculated on the basis of the content of organic C, N, and P. Changes in BOD overtime were studied, giving an idea of the consumption of oxygen in the oxidation of stable organic compounds. Alterations in the color of the water and increases in transparency were also observed. In addition, dialysis experiments were conducted to study the nature of humic compounds contained in the water.
Author

N76-23820 British Library Lending Div., Boston Spa (England).
ON THE INFLUENCE OF DISSOLVED CARBON DIOXIDE ON BIOSYNTHETIC PROCESSES
T. S. Sherstobitova and E. S. Bylinkina 1975 15 p refs Transl. into ENGLISH from Antibiotiki (USSR), v. 20, no. 3, 1975 p 275-281
(BLL-TPI-Trans-0876-(9056.525)) Avail: British Library Lending Div., Boston Spa, Engl.

To aid in the investigation of the influence of dissolved carbon dioxide on biosynthetic processes, a number of techniques were devised for the determination of the concentration of bicarbonate ions in the medium, the overall rate constant for the evolution of carbon dioxide, and other factors.
D.M.L.

N76-23821# Israeli Program for Scientific Translations Ltd., Jerusalem.
ARTIFICIAL AND NATURAL RADIONUCLIDES IN MARINE LIFE
V. G. Tsytsugina, N. S. Risik, G. E. Lazorenko, and B. G. Polikarpov, ed. 1975 120 p refs Transl. into ENGLISH of the book "Iskusstvennye i estestvennye radionuklidy v zhizni Gidrobiontov" Kiev, Nauk Dumka, 1973 120 p Sponsored by US-Israel Binatl. Sci. Found.
(TT-75-50010; ISBN-0-7065-1509-9) Copyright. Avail: NTIS HC $5.50

The karyological and radiation cytogenetics of marine fish were studied along with the effects of radionuclides on their chromosomes. The accumulation and microdistribution of uranium in marine organisms, and the extraction of radionuclides by alginic acid are discussed.
F.O.S.

N76-23822*# Old Dominion Univ. Research Foundation, Norfolk, Va.
MEASUREMENT OF TRANSPIRATION IN PINUS TAEDA L. AND LIQUIDAMBAR STYRACIFLUA L. IN AN ENVIRONMENTAL CHAMBER USING TRITIATED WATER
Gerald F. Levy, Daniel E. Sonenshine, and Joan K. Czoch May 1976 26 p refs
(Grant NGL-47-003-067)
(NASA-CR-147924; PGSTR-BAP76-32) Avail: NTIS HC $4.00 CSCL 06C

Transpiration rates of loblolly pine (Pinus taeda L.) and sweetgum (Liquidambar styraciflua L.) were measured at two different atmospheric water vapor pressure deficits (V.P.D.) in a controlled environment growth chamber using tritiated water as a tracer. The trees were maintained in a sealed plant bed containing a hydroponic nutrient solution into which labeled water (spike) was introduced. Samples of leaves, chamber air, spiked nutrient solution and control water were assayed for ratio-activity using liquid scintillation techniques to determine transpiration rates. The transpiration rate of sweetgum in ml./hr./gm. (4.95) was found to be 5 times greater than that of loblolly pine (1.03) at 1.84 V.P.D. and 8 times greater at 6.74 V.P.D. (15.99 for sweetgum vs. 2.19 for pine). Transpiration (based on measurements of leaf radioactivity) in both species rose with increasing deficit; however sweetgum increased its output by 3 times while pine only doubled its rate. Cyclical changes in transpiration rates were noted in both species; the sweetgum cycle required a 6 hour interval whereas the pine cycle required a 9 hour interval.
Author

N76-23823# Civil Aeromedical Inst., Oklahoma City, Okla.
INTERACTION BETWEEN MARIJUANA AND ALTITUDE ON A COMPLEX BEHAVIORAL TASK IN BABOONS
Mark F. Lewis, Douglas Peter Ferraro (New Mexico Univ., Albuquerque), Henry W. Mertens, and JoAnn Steen Aug. 1975 6 p refs
(AD-A020680/5; FAA-AM-75-6) Avail: NTIS HC $3.50 CSCL 06/15

The effects on performance of any interaction between hypoxia and marijuana were studied. Two baboons were trained to perform on a delayed matching-to-sample task at ground level and altitudes of 8,000 and 12,000 feet. The animals were orally administered doses of marijuana ranging from 0.25 to 2.0 mg/kg, 2 hours prior to experimental sessions at each altitude. No effects on accuracy of matching performance were observed for any of the drug doses or altitudes used. Amount of work output was markedly reduced by the higher drug doses at the 8,000 and 12,000-feet altitudes. This interaction suggests that the behavioral impairment produced by marijuana can be potentiated by hypoxia.
Author

N76-23824*# Boeing Co., Houston, Tex.
DEVELOPMENT OF A CHEMILUMINESCENT AND BIOLUMINESCENT SYSTEM FOR THE DETECTION OF BACTERIA IN WASTEWATER EFFLUENT Quarterly Report, Sep. - Dec. 1975
Richard R. Thomas 1975 50 p refs
(Contract NAS5-22545)
(NASA-CR-144750; Rept-1) Avail: NTIS HC $4.00 CSCL 06B

Automated chemiluminescent and bioluminescent sensors were developed for continuous monitoring of microbial levels in wastewater effluent. Development of the chemiluminescent system included optimization of reagent concentrations as well as two new techniques which will allow for increased sensitivity and specificity. The optimal reagent concentrations are 0.0025 M luminol and 0.0125 M sodium perborate in 0.75N sodium hydroxide before addition of sample. The methods developed to increase specificity include (1) extraction of porphyrins from bacteria collected in a filter using 0.1N NaOH - 50 percent Ethanol, and (2) use of the specific reaction rate characteristics for the different luminol catalysts. Since reaction times are different for each catalyst, the reaction can be made specific for bacteria by measuring only the light emission from the particular reaction time zone specific for bacteria. Developments of the bioluminescent firefly luciferase system were in the area of flow system design.
Author

N76-23825# Pacific Northwest Environmental Research Lab., Corvallis, Ore.
PROCEEDINGS: BIOSTIMULATION/AND/NUTRIENT ASSESSMENT WORKSHOP Ecological Research Series.
Jun. 1975 325 p refs Workshop held at Corvallis, Oreg., 16-17 Oct. 1973
(PB-247229/8; EPA-660/3-75-034) Avail: NTIS HC $9.75 CSCL 06F

The workshop was held to bring together those investigators in the Environmental Protection Agency who are actively engaged in research relating to biostimulation and nutrient assessment to present the results of their studies. The papers presented were concerned with the results of algal assays conducted on various waters and wastes to determine their biostimulatory effects as well as the results of other research relating to the assessment of nutrients and their effects on the aquatic ecosystem.
GRA

N76-23826# Life Systems, Inc., Cleveland, Ohio.
ENZYME ALARM CHARACTERIZATION STUDIES Final Report, 10 Feb. - 30 Nov. 1975
Ronald J. Davenport and Tom S. Steenson Dec. 1975 46 p refs

(Contract DAAA15-75-C-0032)
(AD-A018761; LSI-ER-76037; ED-CR-234-6) Avail: NTIS CSCL 15/2

The performance of the Enzyme Alarm was characterized in order to obtain data useful for increasing the speed of alarm response to large quantities of toxic agents. The response time of the alarm was measured when the enzyme inactivation by agents was chemically simulated. The effect on alarm response time of changes in applied cell current, enzyme substrate, anode materials, and electrode orientation was quantified. Platinum (Pt) and pyrolytic graphite anodes were studied. Conclusions and recommendations are given. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-23827 West Virginia Univ., Morgantown.
A COMPREHENSIVE ANALYSIS OF HEAD AND NECK DYNAMICS ARISING FROM IMPACT AND INERTIA FORCES Ph.D. Thesis
Jeffery Charles Huston 1975 247 p
Avail: Univ. Microfilms Order No. 76-11767

The development of a three-dimensional rigid body dynamics model of the human head and neck region is presented. This model predicts the center of mass displacements, velocities, and accelerations of the head and neck resulting from high impulsive and inertial forces. Key anatomical components such as intervertebral discs, ligaments, and muscles are incorporated into the model. Joint stopping mechanisms are also included to limit the model's range of motion. Any number up to six degrees of freedom can be specified at each joint. This allows for simulation of both a simple hinge-type joint such as the jaw or a more complicated joint as found between two vertebrae. The developed model has the ability to predict head and neck motion and injury as well as any experimental method without the high expenses involved. Dissert. Abstr.

N76-23828 British Library Lending Div., Boston Spa (England).
METHODS FOR THE DETECTION OF DISTURBANCES IN THE LIVING BODY
M. Kimura Dec. 1975 24 p refs Transl. into ENGLISH from Sogo Rinsho (Japan), v. 23, no. 1, 1974 p 107-116
(BLL-RTS-9632) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 40 BLL photocopy coupons

Clinical methods for analyzing toxic substances from pollutants which cause human disorders and affect public health (i.e., occupational diseases) are examined. Urine and blood tests for lead pollutants are examined and the mechanisms by which lead affects enzyme biochemistry (i.e., hemoglobin synthesis) are discussed. Methods for determining cadmium toxicity by urine tests are outlined (i.e., proteins found in urine are analyzed on a molecular weight basis). Various analytical techniques used in the biochemical analysis of proteins (i.e., gel filtration, electrophoresis) are examined. A listing of the enzymes affected by mercury, lead, and cadmium in experimental animals (rats, mice, rabbits etc.) is given. J.R.T.

N76-23829 British Library Lending Div., Boston Spa (England).
BACKACHE IN HELICOPTER PILOTS. ANALYSIS, ETIOLOGY, TREATMENT AND PREVENTION
R. Sliosberg Sep. 1975 12 p Transl. into ENGLISH from Rept. and Commun. of the Intern. Aeron. and Cosmonautical Med. Congr., 11th Congr. in Europe (Madrid), 1962 p 145-151
(BLL-RAE-Lib-Trans-1857-(5207)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Spinal complaints in 128 helicopter pilots, all of whom had at least 500 hours experience were examined. It was shown that 87.5% suffered from spinal pain when flying, the majority in the lumbar region. However the incidence of cervical and thoracic spinal pain was also high. Classically these complaints start after approximately 300 hours flying and were more likely to occur if the previous intensity of flying had been high. Once established the affected pilots suffered back pain on all but the shortest flights. The main aetiology of the condition was twofold: the posture adopted by the pilot to fly the helicopter and the relatively high vibration levels present in helicopters. It is considered that the incidence and seriousness of the problem can be reduced by a variety of measures described in this report. Author

N76-23830 Yale Univ., New Haven, Conn.
STUDY OF THE ACTION OF HUMAN KB CELL RIBONUCLEASE NU AND ESCHERICHIA COLI RIBONUCLEASE P Ph.D. Thesis
Alfred Lester Meador Bothwell 1975 177 p
Avail: Univ. Microfilms Order No. 76-11246

Ribonuclease activities found in extracts of human KB cells were studied and compared with Escherichia coli RNases. RNase NU was partially purified from human cells and characterized. Detailed information concerning the RNA structure and sequence recognized by RNase NU was obtained from studying cleavage reactions on natural RNAs of known nucleotide sequence. Other investigations indicate that RNase P functions in vivo to process RNA precursor. Therefore, the function of RNase P in vivo is not restricted to transfer RNA biosynthesis. The sequence of the extra nucleotides found in the precursor were determined with the aid of RNase P and RNase NU. Studies of the Escherichia coli RNase P cleavage reaction on several well-defined RNA substrates also revealed aspects of secondary and tertiary structure which are important for RNase P-substrate recognition. A model is presented for two types of RNase P-substrate interaction. Dissert. Abstr.

N76-23831 Texas Univ. Health Science Center, Dallas.
THE STRESS PHONOCARDIOGRAM Ph.D. Thesis
Stuart Alonzo Bergman, Jr. 1975 142 p
Avail: Univ. Microfilms Order No. 76-11832

The phonocardiogram was used during stress testing to evaluate its usefulness as an adjunct to the modern exercise test electrocardiogram. It was reasoned that if heart sounds reflect cardiac mechanical behavior, their recording during stress by phonocardiography may document ventricular dysfunction not apparent at rest. After appropriate recording system and stress protocols were established, a series of experiments were conducted - first on animals; then on normal volunteers; and finally on patients with coronary artery disease. First heart sound amplitude is sensitive to changes in myocardial performance and follows peak left ventricular pressure rise in magnitude and direction over a wide range of contractile states. The stress phonocardiogram appears to be a useful adjunct to the evaluation of patients with latent ventricular dysfunction, especially that associated with coronary heart disease, but also to physiological derangements which alter ventricular performance. Dissert. Abstr.

N76-23832 California Univ., Santa Barbara.
THE EFFECTS OF PROLONGED ACUTE HYPOZIA ON CORONARY BLOOD FLOW, MYOCARDIAL METABOLISM AND CARDIOVASCULAR DYNAMICS Ph.D. Thesis
Julian Frank Borgia 1975 240 p
Avail: Univ. Microfilms Order No. 76-9880

Anesthetized intact dogs were exposed for 75 minutes to either 5.75, 9.0 or 12.0 per cent oxygen in nitrogen. Control subjects were exposed to 21 per cent O2 for the same duration and all responses were compared over time by multifactorial analysis of variance. Cardiac index (CI) significantly increased only during severe hypoxia (5.75 per cent O2); however, the elevation CI did not occur until 30 minutes after the onset of hypoxia. Thereafter, cardiac index decreased as a consequence of a gradual increase in arterial hemoglobin concentration (and oxygen carrying capacity), which averaged 26 per cent above controls at 75 minutes. Although heart rate initially increased during hypoxia, the elevation in CI occurred exclusively through augmentation of stroke volume. Pulmonary hypertension was observed at all levels of hypoxia. Conversely, a statistically significant increase in systemic arterial pressure occurred during the initial 15 minutes of exposure to 5.75 per cent O2; and, thereafter, was reduced to control levels. Dissert. Abstr.

N76-23833 Colorado Univ., Boulder.
A MATHEMATICAL MODEL OF THE HUMAN SPINE AND ITS APPLICATION TO THE CERVICAL SPINE

Ph.D. Thesis
Sung Won Hong 1975 207 p
Avail: Univ. Microfilms Order No. 76-11585

A direct method which is a nonlinear procedure to deal with the natural nonlinear problems directly is developed for modeling the human spine. The nonlinearities of material and geometrical factors are also directly included in the model without any linearization process to approximate the mathematical expressions. The computational technique using the digital computer has been emphasized to solve the large-scale nonlinear equations effectively for the spinal model. The Newton-Raphson and the modified Newton-Raphson methods have been used and the PROGRAM SPINE1 and PROGRAM SPINE2 are the results. This spinal model is then applied to analyze the displacement of the cervical spine because of its variety of motion and integrity in its anatomy. Various techniques of computer graphics are discussed to make efficient display of the behavior of the model. Dissert. Abstr.

N76-23834* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 153)
Apr. 1976 60 p
(NASA-SP-7011(153)) Avail: NTIS HC $4.00 CSCL 06E

This bibliography lists 175 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1976. Author

N76-23835 Vermont Univ., Burlington.
AN INSTRUMENT FOR MICROSCOPICAL OBSERVATION OF THE BIOPHYSICAL EFFECTS OF ULTRASOUND Ph.D. Thesis
Douglas Lawrence Miller 1976 112 p
Avail: Univ. Microfilms Order No. 76-11867

The microscopical observation of test objects under ultrasonic irradiation has been a fruitful method of studying biophysical effects of ultrasound. An instrument was constructed with two 1.0 in. diameter quartz discs, a driver which was thickness resonant at 1.0 MHz, and a thin cover concentrically mounted on the stage of a microscope. General observations of the test space included descriptions of acoustic streaming, low frequency surface waves and acoustic cavitation. A study was made of the migration of 45 micrometer diameter polystyrene spheres suspended in water, and substantial agreement was found between photographically determined particle velocities and velocities calculated from radiation force theory applied to the calibrated field. Dissert. Abstr.

N76-23836*# Scientific Translation Service, Santa Barbara, Calif.
ERYTHROPOIETIC PROPERTIES OF PLASMA IN HYPODYNAMIA
M. M. Shcherba, O. I. Moiseyeva, A. M. Volzhskaya, and Ye. N. Glazunov Washington NASA May 1976 12 p refs Transl. into ENGLISH from Fiziologicheskiy zh. SSSR (USSR), v. 61, no. 12, 1975 p 1825-1830
(Contract NASw-2791)
(NASA-TT-F-17019) Avail: NTIS HC $3.50 CSCL 06P

Hypodynamia reduces the amount of erythropoietin in plasma, and as a result, in the majority of subjects (16 out of 21) the erythropoiesis inhibitor was detected on the 8th day of motor activity limitation. The erythropoietic properties of plasma are of the same type in control and recovery periods, which indicates a high level of production of erythropoietin during readaptation. Author

N76-23837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED TISSUE MACERATING INSTRUMENT Patent Application
E. F. Baehr and J. E. Burnett, inventors (to NASA) Filed 15 Apr. 1976 9 p
(NASA-Case-LEW-12668-1; US-Patent-Appl-SN-677353) Avail: NTIS HC $3.50 CSCL 06B

A surgical-tissue macerating and removal tool is reported that lies a rotating rod with a cutting member at one end. The device is placed in a tube which itself is disposed coaxially in an extension of the tool handle. A frusto-conical member extends into the extension at the cutter member end of the rotating rod with its small end engaging the tube. The portion of the frusto-conical member outside of the extension forms a tissue engaging member and may be cut off at an angle of the axis of the rod to form a tissue engaging edge. Apertures are provided in the extension adjacent the frusto-conical member so that treatment fluid supplied in the annular space between the tube and the extension may flow to the operative site. An aperture is provided in the frusto-conical member between the extension and the tube so that fluid may also flow into the tube where it mixes with macerated tissue being directed through an aperture in the tube to a passageway which may have suction applied thereto to help remove macerated material. NASA

N76-23838# Civil Aeromedical Inst., Oklahoma City, Okla.
PILOT PERFORMANCE AND HEART RATE DURING IN-FLIGHT USE OF A COMPACT INSTRUMENT DISPLAY Final Report
Howard A. Hasbrook, Paul G. Rasmussen, and David M. Willis Nov. 1975 13 p refs
(AD-A021519/4; FAA-AM-75-12) Avail: NTIS HC $3.50 CSCL 01/2

An in-flight study of pilot performance was conducted while using an experimental instrument display. The display was used in flight by low time and high time professional pilots. The major findings of this study indicate that pilot performance with the high contrast instrument display, which employs a vertical and horizontal format and occupies substantially less space than conventional instruments, is equal to pilot performance with conventional instruments, in spite of little familiarization time and without regard to pilot experience. No difference in stress (as measured by heart rate) was evident between experimental and conventional displays. Subjective reaction of the pilot subjects to the new type display was favorable. Panel space requirements can be reduced by at least 25 percent by use of the design concepts outlined in this study. Author

N76-23839# Civil Aeromedical Inst., Oklahoma City, Okla.
STRESS IN AIR TRAFFIC CONTROLLERS: COMPARISON OF TWO AIR ROUTE TRAFFIC CONTROL CENTERS ON DIFFERENT SHIFT ROTATION PATTERNS Final Report
C. E. Melton, R. C. Smith, J. M. McKenzie, J. T. Saldivar, S. M. Hoffmann, and P. R. Fowler Sep. 1975 12 p refs
(AD-A020679/7; FAA-AM-75-7) Avail: NTIS HC $3.50 CSCL 05/10

Stress in 23 air traffic controllers (ATCS) at Atlanta Air Route Traffic Control Center (ATL) on the straight 5-day shift rotation schedule was compared with stress in 23 ATCS's on the 2-2-1 shift rotation schedule at Fort Worth Air Route Traffic Control Center (FTW). Stress in six other FTW ATCS's on the 5-day schedule was compared to stress in their 23 cohorts on the 2-2-1 schedule. Stress estimates were made from urinary levels of 17-ketogenic steroids (st), epinephrine (e), and norepinephrine (ne). Levels of st and ne were significantly higher for ATL ATCS's under all conditions. Ranking by composite stress index (C sub s) of ATC facilities showed that ATL ranked third and FTW, ninth. When C sub s was calculated for shifts, FTW ranked last in stressfulness on all shifts. ATL ranked fifth on the day shift and second on the evening shift. It is concluded that physiological stress at ATL is significantly greater than at FTW. The difference probably cannot be accounted for by the shift schedules, since stress in the group at FTW on the 5-day schedule does not differ significantly from stress in their cohorts on the 2-2-1 schedule. Author

N76-23840# Civil Aeromedical Inst., Oklahoma City, Okla.
FUNCTIONAL STRENGTH OF COMMERCIAL AIRLINE STEWARDESSES
Herbert M. Reynolds and Mackie A. Allgood Nov. 1975 16 p
(AD-A021836/2; FAA-AM-75-13) Avail: NTIS HC $3.50 CSCL 06/16

Data from 13 body measurements and 4 strength tests on 152 female flight attendants are reported herein. The stewardesses are taller and lighter than the corresponding age in the civilian population. The strength tests are reported as the average plateau, maximum force, and pound/second force for a two handed push, leg lift, back lift, and arm lift. There are no comparable data in the literature; thus, these data can provide a general guideline

as to the maximum strength capabilities of the on-line airline stewardess. Author

N76-23841# Civil Aeromedical Inst., Oklahoma City, Okla.
THE EFFECTS OF DEXTROAMPHETAMINE ON PHYSIOLOGICAL RESPONSES AND COMPLEX PERFORMANCE DURING SLEEP LOSS Final Report
E. A. Higgins, W. D. Chiles, J. M. McKenzie, P. F. Iampietro (AFOSR, Arlington, Va.), J. A. Vaughan, G. E. Funkhouser, M. J. Burr, A. E. Jennings, and G. West Nov. 1975 12 p refs
(AD-A021520/2; FAA-AM-75-14) Avail: NTIS HC $3.50 CSCL 06/15

On two separate occasions, performance of 10 male subjects was measured on the Civil Aeromedical Institute Multiple Task Performance Battery at 4-hour intervals for a period of 24 hours without sleep. Each subject received a capsule at 4-hour intervals beginning at 2000. On one occasion, the first three doses contained 5 mg each of dextroamphetamine sulfate followed by placebos for the remaining three capsules. On the other occasion, all capsules were placebos. Results of the experiment demonstrated that the dextroamphetamine sulfate sustained a high level of proficiency and alertness and delayed the effects of fatigue for 8 to 12 hours after the ingestion of the third and final drug capsule. Heart rate, rectal temperature, and urinary excretion rates of catecholamines were elevated with this drug. These increases could support the enhancement of proficiency and alertness demonstrated with amphetamines. Neither the subjects' feelings of fatigue nor the accuracy of their estimates of performance capabilities differed significantly in these two test conditions. Author

N76-23842# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF ELECTROMAGNETIC FIELDS BELOW 30 MHz ON ANIMAL BIOLOGY
J. H. Pierluissi (Texas Univ., El Paso) 15 Aug. 1975 16 p refs
(Contract W-7405-eng-48)
(UCRL-51880) Avail: NTIS HC $4.00

The literature describing the effects of radio frequency (rf) electromagnetic fields on animal biology is reviewed. Also, a table is provided which summarizes organic (nonthermal) effects on various biological organisms as found by 30 researchers. Author (ERA)

N76-23843# Joint Publications Research Service, Arlington, Va.
REACTION OF THE ATPase ACTIVITY OF THE ACTION OF DENSELY AND SPARSELY IONIZING RADIATIONS
V. M. Andrianov, E. E. Chebotarev, P. N. Kulyabko, and I. A. Roiter 1975 181 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 15, no. 2, 1975 p 171-328 Sponsored by ERDA
(ERDA-TR-51) Avail: NTIS

Whole-body irradiation of animals with fast neutrons and X rays disrupts the ATPase activity in liver tissues. The difference in the action of these types of ionizing radiations lies in the fact that during the first hours after irradiation with fast neutrons, the ATPase activity is suppressed chiefly in the nuclei of the hepatocyte, and after X irradiation in the cytoplasm. Author (ERA)

N76-23607 Ohio State Univ., Columbus.
SURVEY OF THEORETICAL AND EXPERIMENTAL MECHANICS APPLIED TO HEAD INJURY
Ali E. Engin and Ann W. Engin *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Dig., Vol. 7, No. 3, 1975 Mar. 1975 p 78-90 refs (For availability see N76-23604 14-39)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-23844# MAN-Acoustics and Noise, Inc., Seattle, Wash.
REVIEW OF STUDIES INVESTIGATING HUMAN RESPONSE TO COMMERCIAL AIRCRAFT NOISE Final Report
Nov. 1975 156 p refs
(Contract DOT-FA74WAI-439)
(AD-A022356/0; MAN-1011B; FAA-RD-75-182) Avail: NTIS HC $6.75 CSCL 06/19

Empirical studies involving human response to commercial aircraft/airport noise are reviewed. The review was limited to studies that involved response to actual or recorded flyover signals of conventional takeoff and landing (CTOL) aircraft. Study methods identified were laboratory, field studies, social survey approach, complaint studies, damage risk, interference type studies, and combination methods. Author

N76-23845# Minnesota Univ., Minneapolis. Dept. of Psychology.
A STUDY OF COMPUTER-ADMINISTERED STRADAPTIVE ABILITY TESTING
C. David Vale and David J. Weiss Oct. 1975 52 p refs
(Contract N00014-67-C-0113-0029; NR Proj. 150-343; RR0420401)
(AD-A018758; RR-75-4) Avail: NTIS CSCL 05/10

A conventional vocabulary test and two forms of a stradaptive vocabulary test were administered by a time-shared computer system to undergraduate college students. The two stradaptive tests differed in that one counted question mark responses (i.e., omitted items) as incorrect and the other ignored items responded to with question marks. Analysis of difficulties of items associated with correct, incorrect, and question mark responses suggested that items with question mark responses should not be ignored, but should be treated as incorrect responses in branching decisions. Suggestions for future research on the stradaptive testing model are made. GRA

N76-23846# Navy Personnel Research and Development Center, San Diego, Calif.
A COMPARISON OF ADAPTIVE AND NONADAPTIVE TRAINING STRATEGIES IN THE ACQUISITION OF A PHYSICALLY COMPLEX PSYCHOMOTOR SKILL Interim Report, Jul. 1974 - Jul. 1975
James A. Riedel, Macy L. Abrams, and David Post Dec. 1975 37 p refs
(PF55522004)
(AD-A018880; NPRDC-TR-76-24) Avail: NTIS CSCL 05/9

The relative effectiveness of using adaptive and nonadaptive (fixed) strategies to facilitate acquisition of a physically complex psychomotor skill was investigated. In addition, task and practice difficulty levels were studied. Sixty subjects were each given pre- and post-training tests, and the data were evaluated by analysis of covariance. Results suggest no significant difference between fixed and adaptive techniques for the skill studied. The results are discussed and recommendations made. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-23847 British Library Lending Div., Boston Spa (England).
MAXIMUM FORCES EXERTED BY MEN IN THE ZONE OF MOVEMENT OF THE ARMS AND LEGS
W. Rohmert Sep. 1975 34 p refs Transl. into ENGLISH from Forschungsber. des Landes Nordrhein-Westfalen (West Germany), no. 1616, 1966
(BLL-RAE-Lib-Trans-1839-(5207)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Maximum force measurements are carried out on five students in the zone of movement of the arms in the six coordinate directions and for both rotational directions, as well as in the zone of movement of the legs as maximum foot forces in the plane of symmetry of the body. The results are summarized in a biometric atlas using plotted isodynes. The accuracy of force

measurements is discussed. In order to present the individual scatter in the position of the isodynes, the results are compared with earlier random investigations on a group of 60 students.
Author

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N76-23848*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE Semiannual Review, 1 Jul. - 30 Dec. 1975
18 Apr. 1976 127 p refs
(Contract NAS7-100)
(NASA-CR-147933; JPL-900-732) Avail: NTIS HC $6.00 CSCL 06M

The overall objective is to identify those areas of future missions which will be impacted by planetary quarantine (PQ) constraints. The objective of the phase being described was to develop an approach for using decision theory in performing a PQ analysis for a Mariner Jupiter Uranus Mission and to compare it with the traditional approach used for other missions. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N76-23849 British Library Lending Div., Boston Spa (England).
ON THE PROBLEM OF SELECTING CONDUCTOR COLOURING
I. G. Ilzinya Dec. 1975 5 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 9, 1965 p 161-163
(BLL-RTS-10092) Avail: British Library Lending Div., Boston Spa, Engl.: £2.00; 3 BLL photocopy coupons

The coloring of vertices for some actual graphs relating to mounting plates of automatic telephone exchanges was considered. A graph corresponding to a wiring scheme was constructed such that the conductors are the vertices of the graph and the forbiddances of color coincidence are the edges, so that each branch has a corresponding complete graph. The entire mounting plate has a corresponding multigraph generated by the individual graphs since two conductors can meet together in more than one branch. The problem of selecting the color of conductors was therefore reduced to coloring the vertices of a simple graph. A matrix was constructed, the rows of which correspond to the branches, and the columns to the conductors. Calculations were performed with a computer. Y.J.A.

N76-23850* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BINARY CONCATENATED CODING SYSTEM Patent
Leo G. Monford, Jr., inventor (to NASA) Issued 18 May 1976 8 p Filed 14 Dec. 1972 Supersedes N73-16163 (11 - 07, p 0795)
(NASA-Case-MSC-14082-1; US-Patent-3,958,238; US-Patent-Appl-SN-315070; US-Patent-Class-340-347P; US-Patent-Class-340-347DD) Avail: US Patent Office CSCL 09B

The patent of a system for measuring, counting, and recording numerical information using binary notation with a minimized number of digits or bits, a system that may frequently be used to better advantage than the well known binary pulse code modulation system, or the delta modulation system was presented. In the binary concatenated coding system, a three-bit data word is used to count all whole numbers from zero through 99. In any one of the 10 decades this is accomplished by starting with a one, progressing stepwise from one to seven and then to zero in a binary fashion, thus providing eight positions corresponding to the first eight numbers of our everyday Arabic system. The ninth and tenth positions are occupied by two of these same eight numbers so selected and arranged that they uniquely describe the decade completed by them relative to the other nine decades of the total count capability of 100. Author

N76-23851 British Library Lending Div., Boston Spa (England).
SWITCHING NETWORKS FOR LARGE TIME DIVISION EXCHANGES
P. Voyer, A. Regnier, K. B. Kevorkian, and J. P. Lager [1975] 23 p refs Transl. into ENGLISH from Commutation et Electronique (France), no. 49, Apr. 1975 p 23-34
(BLL-Trans-3292-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The main choices are considered for a PCM time division switching network for a transit exchange or for a large local exchange: division of the network into two independent branches, each handling half the traffic in a load-sharing mode; TST (time-space-time division) structure; and operating speed 4 Mbit/s. Author

N76-23852 Oregon State Univ., Corvallis.
INFORMATION PROCESSING ERRORS IN LINEAR FEEDBACK CONTROL SYSTEMS Ph.D. Thesis
Hoi-Yeung Chong 1976 224 p
Avail: Univ. Microfilms Order No. 76-9843

The analysis of the effect of finite wordlength, channel capacity and source rate in digital feedback control of linear systems was studied. The cases considered are (1) finite wordlength A/D conversion, no feedback delay, ideal ROM (read only memory) controller; (2) finite A/D wordlength (source rate), state feedback delay with fixed-point computer execution of prediction and control algorithms; and (3) finite A/D wordlength, state feedback delay with floating-point computer execution of prediction and control algorithms. In each case, a sufficient condition for the system stability is given. In fixed-point computer control, computer round off error does not permit arbitrarily fine regulation, and the feedback channel may fail to stabilize an open-loop unstable system. In floating-point computer control, the effect of round off error appears as a perturbation matrix in the transition matrix, and there is a tradeoff between channel capacity, source rate and computer wordlength for system stability. Dissert. Abstr.

N76-23853 British Library Lending Div., Boston Spa (England).
STATE OF THE ART IN DATA SWITCHING
P. Lucas, A. Texier, and E. Lapeyronnie [1975] 35 p refs Transl. into ENGLISH from Commutation et Electron (France), no. 49, Apr. 1975 p 7-22
(BLL-TRANS-3279-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

After briefly recalling the basic principles maintained for data switching, by packets or by time division circuit switching, the state of the art is discussed. Public data networks are defined and an outline of French projects for the future is provided.
Author

N76-23854 Syracuse Univ., N.Y.
GENERALIZATION OF THE B SPLINE APPROXIMATION AND THEIR APPLICATIONS TO GEOMETRIC PROBLEMS IN COMPUTER AIDED DESIGNS Ph.D. Thesis
Kam-Fook Tse 1975 103 p
Avail: Univ. Microfilms Order No. 76-7688

For approximation by splines of fixed order and fixed partition in computational geometry, the representation of approximating curve or surface is determined by the choice of basis. Presented are the results of two approaches in modifying

the form of the B-spline basis functions. They are: (1) modification of the basis generating algorithm of the integral B-splines; and (2) combination of the B-spline basis functions. With the increase in the number of basis segments of the basis functions in these two approaches, an approximating spline is obtained with better fidelity to the underlying polygon. Dissert. Abstr.

N76-23855 Southern Methodist Univ., Dallas, Tex.
AUTOMATIC DESIGN OF STRUCTURED DATA PROCESSING SYSTEMS Ph.D. Thesis
Leland Lester Beck 1975 197 p
Avail: Univ. Microfilms Order No. 76-11620

For most transaction oriented data processing systems the processing requirements can conveniently be expressed as functions defined on the records of the data base. The framework of a problem oriented language for stating such functions is reported. Methods are given for transforming such a problem statement into a directed network of files and single process modules; this network is then separated into a set of run units. Alternatives for communication between the processes of a run unit are considered. It is shown how this concept allows the flexible use of modern multiprogramming and multiprocessing systems, while retaining many advantages normally associated with a single job environment. Dissert. Abstr.

N76-23856 Ohio State Univ., Columbus.
THE ARCHITECTURAL DESIGN OF A SECURE DATA BASE MANAGEMENT SYSTEM Ph.D. Thesis
Richard Irwin Baum 1975 293 p
Avail: Univ. Microfilms Order No. 76-9932

A hardware architecture is presented to realize a secure, high performance, attribute-oriented data base management machine. The architecture employs content addressibility at the hardware level to implement simple and reliable data base management algorithms. The proposed data base management machine is a physically distinct unit that may be interfaced with any computer system capable of supporting a capability-based protection enforcement mechanism. The architecture consists of four major components: the directory memory, the intersector, the mass storage and the DBMS command preprocessor. The directory memory contains directory information, the mass storage contains the data base, the intersector is used to perform set manipulation operations and the DBMS command preprocessor uses the other components to actually execute data base management algorithms. Dissert. Abstr.

N76-23857 Cornell Univ., Ithaca, N.Y.
ON THE PROBLEM OF DYNAMIC MEMORY MANAGEMENT Ph.D. Thesis
Dennis Way Ting 1975 94 p
Avail: Univ. Microfilms Order No. 76-9571

The problem of dynamic memory allocation is studied. It is found that all allocation algorithms will require in the order of mlogm words of memory to preclude the possibility of memory overflow, where m is the maximum number of busy words at any one time. Dynamic memory compaction is then considered in light of the above result. A cost is defined by which performance of all compaction algorithms is evaluated. Finally, new compaction algorithms are proposed, and their implementations discussed. Dissert. Abstr.

N76-23858*# Texas A&M Univ., College Station.
CONVERSION OF LARSYS III.1 TO AN IBM 370 COMPUTER Final Report
Glen N. Williams, John Leggett, and Glen A. Hascall [1975] 68 p
(Contract NAS9-14514)
(NASA-CR-147708) Avail: NTIS HC $4.50 CSCL 09B

A software system for processing multispectral aircraft or satellite data (LARSYS) was designed and written at the Laboratory for Applications of Remote Sensing at Purdue University. This system, being implemented on an IBM 360/67 computer utilizing the Cambridge Monitor System, is of an interactive nature. TAMU LARSYS maintains the essential capabilities of Purdue's LARSYS. The machine configuration for which it has been converted is an IBM-compatible Amdahl 470V/6 computer utilizing the time sharing option of the currently implemented OS/VS2 Operating System. Due to TSO limitations, the NASA-JSC deliverable TAMU LARSYS is comprised of two parts. Part one is a TSO Control Card Checker for LARSYS control cards, and part two is a batch version of LARSYS. Used together, they afford most of the capabilities of the original LARSYS III.1. Additionally, two programs have been written by TAMU to support LARSYS processing. The first is an ERTS-to-MIST conversion program used to convert ERTS data to the LARSYS input form, the MIST tape. The second is a system runtable code which maintains tape/file location information for the MIST data sets. Author

N76-23859*# System Development Corp., Santa Monica, Calif.
DIGITAL DATA PROCESSING SYSTEM DYNAMIC LOADING ANALYSIS Final Report
J. J. Lagas, J. J. Peterka, and A. E. Tucker 8 Jun. 1976 259 p refs
(Contract NAS9-14630)
(NASA-CR-147715; TM-(L)-5658/000/00) Avail: NTIS HC $9.00 CSCL 09B

Simulation and analysis of the Space Shuttle Orbiter Digital Data Processing System (DDPS) are reported. The mated flight and postseparation flight phases of the space shuttle's approach and landing test configuration were modeled utilizing the Information Management System Interpretative Model (IMSIM) in a computerized simulation modeling of the ALT hardware, software, and workload. System requirements simulated for the ALT configuration were defined. Sensitivity analyses determined areas of potential data flow problems in DDPS operation. Based on the defined system requirements and the sensitivity analyses, a test design is described for adapting, parameterizing, and executing the IMSIM. Varying load and stress conditions for the model execution are given. The analyses of the computer simulation runs were documented as results, conclusions, and recommendations for DDPS improvements. Author

N76-23860*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RAPID: A RANDOM ACCESS PICTURE DIGITIZER, DISPLAY, AND MEMORY SYSTEM
Y. Yakimovsky, M. Rayfield, and R. Eskenazi 15 May 1976 29 p
(Contract NAS7-100)
(NASA-CR-147945; JPL-TM-33-772) Avail: NTIS HC $4.00 CSCL 09B

RAPID is a system capable of providing convenient digital analysis of video data in real-time. It has two modes of operation. The first allows for continuous digitization of an EIA RS-170 video signal. Each frame in the video signal is digitized and written in 1/30 of a second into RAPID's internal memory. The second mode leaves the content of the internal memory independent of the current input video. In both modes of operation the image contained in the memory is used to generate an EIA RS-170 composite video output signal representing the digitized image in the memory so that it can be displayed on a monitor. Author

N76-23861# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF THE TESDATA MODEL 1155 HARDWARE MONITOR SYSTEM Final Report, Jul. 1974 - Apr. 1975
Donald Fisher Feb. 1976 19 p refs
(AD-A022077/2; FAA-NA-75-48; FAA-RD-75-235) Avail: NTIS HC $3.50 CSCL 09/2

A Tesdata model 1155 hardware monitor system was installed, tested, and evaluated at the National Aviation Facilities Experimental Center to determine its ability and usefulness in performing measurement tasks on the National Airspace System 9020 computers. It was determined that this system meets or exceeds performance specifications and can be utilized on any of the 9020 computers without interference to the host system. Although the batch analyzer data reduction package provided with the monitor produces the reports described by the manufacturer, the amount of computer time required to perform data reduction is excessive. Author

N76-23862*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
PROGRAM DOCUMENTATION CREW SYSTEM VIDAR DATA REDUCTION (CSVIDR) PROGRAM

H. B. VanWie Mar. 1976 99 p
(Contract NAS9-12200)
(NASA-CR-147709; LEC-7253; JSC-10948) Avail: NTIS HC $5.00 CSCL 09B

The Crew System Vidar Data Reduction (CSVIDR) program was written to process selected portions of data acquired from long term tests of space shuttle crew equipment. Data are recorded on a seven track computer compatible tape using the Vidar autodata eight processing system. The input tape is in a six bit binary coded decimal format. The 1110 hardware conversion option is used to convert all data from a BCD format to Fieldata since the majority of the data is output without further conversion. Data is retrieved from a character string, calibrated, tabulated, printed, and output on a fixed sample rate tape for use as input to a general purpose plot program. Author

N76-23863# California Univ., Livermore. Lawrence Livermore Lab.
DISPLAY TERMINAL WITH ALPHANUMERIC AND GRAPHIC DISPLAY CAPABILITY, FOR MICROCOMPUTERS
J. M. Spann 29 Aug. 1974 8 p Presented at the IEEE Computer Soc. Ann. Conf., Washington, D. C., 29 Aug. 1974 Sponsored by ERDA
(UCRL-75617; Conf-7408060-1) Avail: NTIS HC $4.00

The design, construction, and operating features of a display system incorporated into a modular input/output terminal are described. The display system comprises a raster scan TV monitor, an MCS-8 microcomputer system, and an electronics unit which provides the interface between the two. The modular I/O terminal includes a solid-state keyboard. The display system is capable of both alphanumeric and graphical displays. ERA

N76-23864# Los Alamos Scientific Lab., N.Mex.
MUMPS CODE BUILDING PACKAGE FOR DATA-BASE MANAGEMENT
C. A. Goad Aug. 1975 27 p
(Contract W-7405-eng-36)
(LA-6065-MS) Avail: NTIS HC $4.00

The MUMPS code-building package described in this report is a collection of MUMPS-11 codes which, given logical specifications set up by a user, automatically construct MUMPS programs. The programs built by the package accomplish various data-base manipulation tasks, such as user interrogation and the searching, sorting, and listing of data stored in MUMPS globals. The programs may be used to construct codes useful for listing records from a file. An example cited is a hospital patient data file. ERA

N76-23865# Joint Inst. for Nuclear Research, Dubna (USSR).
CAMAC SYSTEM ORGANIZATION FOR A READOUT FROM VARIOUS GROUPS OF MODULES
N. I. Zhuravlev, A. G. Petrov, V. I. Sidorov, A. N. Sinaev, and I. N. Churin 1975 20 p refs In RUSSIAN
(JINR-P10-9056) Avail: ERDA Depository Libraries HC $4.00

A CAMAC system based on a read-only controller operating in the address scan mode and a special LAM-grader is described. According to arriving L signals and their patching in the LAM-grader, signals for the following operations can be generated: a readout in the address scan mode, a block transfer from one address disabling the readout from groups of stations, and ending the readout. The system is very flexible and may consist of both one and several crates. Author (ERA)

N76-23866# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
AUTOMATIC PROCESSING OF THE TIME CHARACTERISTICS OF THE WAVEFORM REPEATING PROCESSES USING DIGITAL COMPUTER
Yu. N. Denisov, A. N. Lyubenko, and M. Chihak 1975 14 p refs In RUSSIAN
(JINR-P9-9143) Avail: ERDA Depository Libraries HC $4.50

A method is described that allows automatic processing of the waveform repeating processes in a wide amplitude-time range using a sampling oscilloscope and a digital computer. A system with the OSA-601 type oscilloscope and M-6000 type digital computer is considered. Examples are given using this system. Author (ERA)

N76-23867# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
DC 161 DATA CONTROLLER FOR PROCESS AUTOMATION APPLICATION
R. Didic Jul. 1975 46 p In GERMAN
(KFK-PDV-51) Avail: ERDA Depository Libraries HC $5.00

The DC 161 data controller is programmable unit for process automation applications. It may be used as a central element to control plant equipment, control centers, communication systems, data concentrators, etc. Modular design permits assembly of cost effective dedicated system configurations. Eight program levels, with eight hardware registers each, are provided. Direct program level switching is achieved by simply applying a switching request signal--this provides for a fast reaction to external events. A particular control interface allows internal central processor sequences to be controlled by external functional units. Author (ERA)

N76-23868# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
ACCS ADAPTABLE COMPUTER SIMULATION SYSTEM
P. Kreis and H. Heikel Jul. 1975 83 p refs In GERMAN
(KFK-PDV-52) Avail: ERDA Depository Libraries HC $5.50

A simulation system whose principal area of application is process computer control and related fields is described. The major functional components treated are generator, simulator, and machine description language. The first level of the machine description language is described in special detail. The guiding idea in the system concept is to let the generator receive the particular characteristics of each machine to be simulated from the machine description, and construct an optimal simulator especially tailored to that machine. This method also provides an ideal solution environment for optimization problems which arise in technical and scientific work. The references are intended to be a subjective selection which should allow descriptions and comparisons. An attempt is made to demonstrate some of the problems of simulation by means of a concrete example. Author (ERA)

N76-23869# Stanford Univ., Calif. Dept. of Computer Science.
DISTANCES IN ORIENTATIONS OF GRAPHS
V. Chvatal and G. Thomassen Aug. 1975 28 p refs Prepared in cooperation with Waterloo Univ., Ontario
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402)
(AD-A018426; STAN-CS-75-517) Avail: NTIS CSCL 12/2

The authors prove that there is a function h(k) such that every undirected graph G admits an orientation H with the following property: if an edge uv belongs to a cycle of length k in G then uv or vu belongs to a directed cycle of length at most h(k) in H. Next, it is shown that every undirected bridgeless graph of radius r admits an orientation of radius at most (r sup 2)- r, and this bound is best possible. The same problem is considered with radius replaced by diameter. Finally, it is shown that the problem of deciding whether an undirected graph admits an orientation of diameter (resp. radius) two belongs to a class of problems called NP-hard. GRA

N76-23870# Stanford Univ., Calif. Electronics Labs.
APPLICATIONS OF COMPUTER-AIDED DESIGN TECHNIQUES TO PROCESS, DEVICE AND CIRCUIT DESIGNS
Robert W. Dutton Jun. 1975 220 p refs
(Contract N00014-67-A-0112-0044)
(AD-A018220; TR-5012-1; SU-SEL-75-017) Avail: NTIS CSCL 09/5

This report is a collection of projects completed by 7 students during the course EE 392H given during the Autumn Quarter, 1974. Application of computer-aided design techniques to real problems was the emphasis of this course. The applications ranged from fabrication process simulation through device, circuit and even system design. Author (GRA)

N76-23871# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COOPERATION OF THE GDR-CSSR IN THE REALM OF HYBRID COMPUTER TECHNOLOGY
W. Krug 30 Apr. 1975 18 p Transl. into ENGLISH from

Messen-Steuern-Regeln (East Germany), v. 11, no. 6, Jun. 1974 p 7-86
(AD-A018254; FTD-ID(RS)I-1259-75) Avail: NTIS CSCL 09B

Conference proceedings dealing with the state of the art in hybrid computer technology are reported. Areas considered include: operating systems, control units, program languages, computer storage, dynamic simulation, and areas of application. J.M.S.

N76-23872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEECHECK - A MINICOMPUTER SYSTEM OF DATA COLLECTION AND TRANSMISSION
K. Niecko and J. Szumilewicz 26 Nov. 1975 18 p Transl. into ENGLISH from Budownictwo Okretowe (Poland), v. 20, no. 1, Jan. 1975 p 33-36
(AD-A018469; FTD-ID(RS)I-2213-75) Avail: NTIS CSCL 09/2

The authors present the SEECHECK system which has been installed at their plant and does the collection and preliminary processing of data. The universality of the system as well as its simple operation are noted, even though the system is based on a minicomputer. The feasibility of data input at the place of their origin means that SEECHECK can be widely used in various companies. The system described in the article is the first of this type in the COMECON countries. GRA

N76-23873# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MULTIPROCESSOR DESIGN
W. B. Barker Oct. 1975 281 p refs
(Contracts DAHC15-69-C-0179; F08606-73-C-0027; ARPA Order 2351)
(AD-A018341; BBN-3126) Avail: NTIS CSCL 09/2

This report addresses the issues involved in the design of a multiprocessor. The author explores a wide range of design considerations and arrives at judgments of relative merit at each decision point; the results of these decisions lead to a particular multiprocessor design. A real multiprocessor has been built to this design, and its configuration and performance are described. This system, the Pluribus, has many advantages over other computer systems in cost-effectiveness, reliability, modularity, and expansibility. Author (GRA)

N76-23874# Naval Postgraduate School, Monterey, Calif.
THE DATA GENERAL NOVA 800 MINICOMPUTER AS A DIGITAL CONTROLLER M.S. Thesis
John William Pounds, Jr. Sep. 1975 157 p refs
(AD-A018305) Avail: NTIS CSCL 09/2

The Data General Nova 800 minicomputers is described in detail. An analysis is made of its instruction set and a description is given of available peripheral equipment. The specification criteria for A/D and D/A devices is discussed and the selection of specific devices is supported. The DT 1620 data acquisition system and the DT 212 D/A converter are described. The interface considerations for adapting the A/D and D/A converters to the Nova system are discussed. Programming examples for the combined system are given. A system operation tutorial is offered which includes a programmed instruction section to efficiently familiarize the prospective user. Finally, examples of system use as a digital controller are provided. Author (GRA)

N76-23323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN INTEL 8080 CROSS ASSEMBLER FOR THE MODCOMP 2 MINICOMPUTER
M. W. Sievers *In its* The Deep Space Network 15 Apr. 1976 p 151-163 (For availability see N76-23304 14-12)
CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-23875 Utah Univ., Salt Lake City.
THE ACCOMMODATION OF HUMAN CHARACTERISTICS IN PROGRAMMING LANGUAGE DESIGN Ph.D. Thesis
Bruce Hudson Stowell 1975 213 p
Avail: Univ. Microfilms Order No. 76-10347

A three part experiment is presented that assesses the implications of models of human problem solving for the design of programming languages. Part I describes the relationship between a programming language and the programming process. Programming--the activity of the human in composing a program or in comprehending a program--is considered a problem solving process. Some of the literature on human problem solving is reviewed and a number of problem solving characteristics relevant to programming are identified. Part 2 describes Nexus, a programming language designed to accommodate the characteristics of human problem solving. This accommodation was achieved by considering a variety of existing or proposed language features. Each feature was evaluated to assess its consistency with the desirable language properties or human characteristics identified in Part I. Part 3 describes an implementation of Nexus and answers questions regarding machine interpretation translation and execution. Dissert. Abstr.

N76-23876 Carnegie-Mellon Univ., Pittsburgh, Pa.
VERIFICATION OF SYSTEMS PROGRAMS Ph.D. Thesis
Gideon Ariely 1975 288 p
Avail: Univ. Microfilms Order No. 76-7447

A framework for verification issues of programmed systems is suggested. The framework emphasizes the use of mathematical models and the distinction between model and implementation. The implications of the general framework are explored with respect to: 1. Lisp-like languages, 2. Sequential Algorithms, 3. Program Structures, 4. Parallel Systems. Several criteria for classifying verification techniques are presented, and Search Algorithms are formalized. A presentation theorem concerning Lisp-like languages is proved. Dissert. Abstr.

N76-23877 Texas Univ., Arlington.
AN IMPLICIT ENUMERATION ALGORITHM FOR CLUSTERING PROBLEMS Ph.D. Thesis
S. Chandrasekharan 1975 98 p
Avail. Univ. Microfilms Order No. 76-11673

Two algorithms for solving clustering problems are presented. Given a set of objects, the Euclidean distance between the objects is used as the similarity measure between each pair of objects. The heterogeneity among objects within the same cluster and the heterogeneity among objects belonging to different clusters are defined by the average within-group distance and the average between-group distance respectively. An objective function which minimizes the difference between the average within-group distance and the average between-group distance is used as the criterion to measure the 'goodness' of an allocation. The first algorithm is used to solve for the optimal number of clusters for a given set of objects. The second algorithm can be used to solve for the maximally homogeneous clusters when the desired number of clusters is prescribed. Dissert. Abstr.

N76-23878 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTERVAL CONVEX PROGRAMMING, ORTHOGONAL LINEAR PROGRAMMING, AND PROGRAM GENERATION PROCEDURES Ph.D. Thesis
John Heard Ristroph 1975 196 p
Avail: Univ. Microfilms Order No. 76-11271

The interval convex programming problem is similar to the convex programming problem of the real number system except that all parameters are specified as intervals of real numbers rather than as real scalars. The interval programming solution procedure involves the solution of a series of 2n real valued convex programs where n is the dimension of the space. The solution of an interval programming problem is an interval vector which contains all possible solutions to any real valued convex program which may be realized. Attempts to improve the efficiency of the interval convex programming problem are discussed. The development of a new solution procedure for the real valued linear programming problem, Orthogonal linear programming is presented. This new algorithm evolved from heuristic procedures which were initially examined in the attempt to improve solution efficiency. Dissert. Abstr.

N76-23879 Northwestern Univ., Evanston, Ill.
REDUCTION AND RESTRICTION METHODS FOR SIMPLIFYING AND SOLVING NONLINEAR PROGRAMMING PROBLEMS Ph.D. Thesis
Chu-Tao Wu 1975 112 p
Avail: Univ. Microfilms Order No. 76-11937

Four different formulations of general nonlinear programming are studied. Projection methods are used to reduce problems with unbounded optimal solution set or unattained infimum. By investigating the dual of reduced problems, restriction methods are developed to reduce problems which lack interior points. Numerical examples are given to illustrate the theory. This study unifies and extends some previous results known for linear and geometric programming in which reduction methods have proved to be useful theory and computation. A modified reduced gradient algorithm is developed and applied to dual geometric programming problems. This algorithm takes into account the nondifferentiability of the dual objective function at the boundary. A computer code is written in FORTRAN IV for CDC 6400. Dissert. Abstr.

N76-23880 Utah Univ., Salt Lake City.
A KNOWLEDGEABLE LANGUAGE-INDEPENDENT SYSTEM FOR PROGRAM CONSTRUCTION AND MODIFICATION Ph.D. Thesis
Martin David Yonke 1975 121 p
Avail: Univ. Microfilms Order No. 76-10349

The design of a language-independent system for intelligent creation and modification of programs is presented as an example of such a facility. This system, called the Program Constructor and Modifier, is a two-stage process. In the first stage, an expert creates a description of a programming language in a high-level formalism. This description is used in conjunction with the underlying model of programming languages to drive the second stage, in which the general user creates and modifies programs written in the particular programming language. This model will guarantee that throughout the interaction the program is syntactically error-free and as far as possible without executing the program, will guarantee certain semantic consistencies. All methods associated with this model are oriented towards error prevention while still allowing the user free-form program input. Dissert. Abstr.

N76-23881 Northwestern Univ., Evanston, Ill.
A MODEL OF DATA STRUCTURES COMMONLY USED IN PROGRAMMING LANGUAGES AND DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
William Leonard Honig 1975 423 p
Avail: Univ. Microfilms Order No. 76-11896

Contemporary data structures can be understood and studied with an intelligible model which captures their essential differences and similarities. Such a model is an appropriate basis for a top down description method for data structures. To define the scope of the model, the data structures included in 21 programming languages and data base management systems have been tabulated. Each individual data structure is illustrated with an example drawn from a published paper or a working computer program. This melange of data structures is divided into three classes (aggregates, associations, and files) and each class is modeled with a set of questions. Each question delineates one significant characteristic of the data structure and can be viewed as one axis of a n-dimensional universe of data structures. Dissert. Abstr.

N76-23882 Cornell Univ., Ithaca, N.Y.
PROBLEMS OF ERROR CORRECTION FOR PROGRAMMING LANGUAGES Ph.D. Thesis
Charles Stanley Wetherell 1975 100 p
Avail. Univ. Microfilms Order No. 76-9578

The errors in programming languages are modeled as instances of replacement, deletion, and insertion processes. For purposes of error handling, user errors are treated as independent random events with low probability. Statistical analogs are constructed to the absolute properties needed for correction and to measure these analogs. A probabilistic grammar is developed and used to frame some probabilistic questions about grammer suitability for error correction. A statistical model of an LR(1) parser is built and calculation techniques for some of the measures are given. One working language, XPL, is studied by counting the parser states and grammar productions over a large sample of programs. The collected frequencies are used to build a statistical model and several language and grammar statistics are calculated. The language is then modified and the experiment is repeated. Nearly all of the statistical measures are improved. Results indicate that programming languages, its parser, and its resistance to errors can be measured and these measures can be used to improve the language. Dissert. Abstr.

N76-23883*# Rice Univ., Houston, Tex.
AN ALGORITHM FOR OPTIMAL SINGLE LINEAR FEATURE EXTRACTION FROM SEVERAL GAUSSIAN PATTERN CLASSES
S. A. Starks, R. J. P. DeFigueiredo, and D. L. VanRooy Nov. 1975 18 p refs Sponsored in part by AFOSR
(Contract NAS9-12776)
(NASA-CR-147713; ICSA-TR-275-025-022; EE-TR-7520) Avail: NTIS HC $3.50 CSCL 09B

A computational algorithm is presented for the extraction of an optimal single linear feature from several Gaussian pattern classes. The algorithm minimizes the increase in the probability of misclassification in the transformed (feature) space. Numerical results on the application of this procedure to the remotely sensed data from the Purdue CI flight line as well as LANDSAT data are presented. It was found that classification using the optimal single linear feature yielded a value for the probability of misclassification on the order of 30% less than that obtained by using the best single untransformed feature. Also, the optimal single linear feature gave performance results comparable to those obtained by using the two features which maximized the average divergence. Author

N76-23884*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DABI: A DATA BASE FOR IMAGE ANALYSIS WITH NONDETERMINISTIC INFERENCE CAPABILITY
Y. Yakimovsky and R. Cunningham 15 May 1976 48 p refs
(Contract NAS7-100)
(NASA-CR-147944; JPL-TM-33-773) Avail: NTIS HC $4.00 CSCL 09B

A description is given of the data base used in the perception subsystem of the Mars robot vehicle prototype being implemented at the Jet Propulsion Laboratory. This data base contains two types of information. The first is generic (uninstantiated, abstract) information that specifies the general rules of perception of objects in the expected environments. The second kind of information is a specific (instantiated) description of a structure, i.e., the properties and relations of objects in the specific case being analyzed. The generic knowledge can be used by the approximate reasoning subsystem to obtain information on the specific structures which is not directly measurable by the sensory instruments. Raw measurements are input either from the sensory instruments or a human operator using a CRT or a TTY. Author

N76-23885*# Virginia Univ., Charlottesville. Research Labs. for Engineering Sciences.
THE USE OF GENERAL PURPOSE COMPUTER PROGRAMS TO DERIVE EQUATIONS OF MOTION FOR OPTIMAL ISOLATION STUDIES Final Report
Walter D. Pilkey and Y. H. Chen [1976] 30 p refs
(Grant NGR-47-005-145)
(NASA-CR-144990; ESS-4085-112-75) Avail: NTIS HC $4.00 CSCL 09B

Techniques were developed that utilize general purpose structural analysis computer programs to generate the equations of motion necessary for limiting performance studies. The methodology necessary to couple available general purpose finite element structural programs to a limiting performance capability was developed. Primary emphasis was given to the use of the general purpose program to develop equations of motion in a form that can be used by the limiting performance program. Author

N76-23886*# Control Data Corp., Hampton, Va.
ANOPP PROGRAMMING AND DOCUMENTATION STANDARDS DOCUMENT
[1976] 65 p
(Contract NAS1-13983)
(NASA-CR-144989) Avail: NTIS HC $4.50 CSCL 09B

Standards defining the requirements for preparing software for the Aircraft Noise Prediction Program (ANOPP) were given. It is the intent of these standards to provide definition, design, coding, and documentation criteria for the achievement of a unity among ANOPP products. These standards apply to all of ANOPP's standard software system. The standards encompass philosophy as well as techniques and conventions. Author

N76-23887*# Texas A&M Univ., College Station. Data Processing Center.

AUTOMATIC DOCUMENTATION SYSTEM EXTENSION TO MULTI-MANUFACTURERS' COMPUTERS AND TO MEASURE, IMPROVE, AND PREDICT SOFTWARE RELIABILITY Final Report

Dick B. Simmons Oct. 1975 316 p refs
(Contract NAS5-20715)
(NASA-CR-144748) Avail: NTIS HC $9.75 CSCL 09B

The DOMONIC system has been modified to run on the Univac 1108 and the CDC 6600 as well as the IBM 370 computer system. The DOMONIC monitor system has been implemented to gather data which can be used to optimize the DOMONIC system and to predict the reliability of software developed using DOMONIC. The areas of quality metrics, error characterization, program complexity, program testing, validation and verification are analyzed. A software reliability model for estimating program completion levels and one on which to base system acceptance have been developed. The DAVE system which performs flow analysis and error detection has been converted from the University of Colorado CDC 6400/6600 computer to the IBM 360/370 computer system for use with the DOMONIC system. Author

N76-23888*# Texas A&M Univ., College Station. Data Processing Cent_ .

AUTOMATIC DOCUMENTATION SYSTEM EXTENSION TO MULTI-MANUFACTURERS' COMPUTERS AND TO MEASURE, IMPROVE, AND PREDICT SOFTWARE RELIABILITY. APPENDIX A AND B Final Report

Dick B. Simmons Oct. 1975 225 p refs
(Contract NAS5-20715)
(NASA-CR-144749) Avail: NTIS HC $7.75 CSCL 09B

A manual which explains how to use the DOMONIC command language is presented. The manual consists of the following sections: 1. Introduction 2. What You Must Know to Use DOMONIC 3. Functions of DOMONIC 4. Entering and Manipulating Data 5. Templates and Data Definitions 6. Recipes and Document Generation 7. Initiating A Project and 8. Entering and Changing Security Controls. The first four sections must be known by all DOMONIC users. Sections five, seven and eight describe functions normally used only by project management. Section six tells how to generate documents. The manual specifies what commands to use in performing each of the functions mentioned above. Author

N76-23889*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.

PREVENTION OF DESIGN FLAWS IN MULTICOMPUTER SYSTEMS

Feb. 1975 114 p refs
(Contract NAS9-13970)
(NASA-CR-147657; Rept-1.3-DN-C0204-013) Avail: NTIS HC $5.50 CSCL 09B

Multicomputer configurations and redundancy management techniques used in various airborne systems were investigated to determine methods to prevent and/or treat generic design flaws. The findings are intended for use in the design of a computer system for use in the space shuttle orbiter. D.M.L.

N76-23890# Sandia Labs., Albuquerque, N.Mex.

QUALITY SOFTWARE FOR NON-STIFF ORDINARY DIFFERENTIAL EQUATIONS

L. F. Shampine 1975 4 p Presented at the Natl. Meeting of the Am. Inst. of Chem. Engr., Boston Sponsored by ERDA
(SAND-75-5125; Conf-750902-1) Avail: NTIS HC $4.00

The safety of computer codes is discussed, including the ability to diagnose or otherwise cope with mistakes or misuse of the code. The state of software development in this area is exemplified through discussion of the specific codes DE and RKF45. ERA

N76-23891# Sandia Labs., Albuquerque, N.Mex.

QUALITY SOFTWARE FOR NON-STIFF ORDINARY DIFFERENTIAL EQUATIONS

L. F. Shampine 1975 8 p Presented at the Natl. Meeting of the Am. Inst. of Chemical Engr., Boston Sponsored by ERDA
(SAND-75-5729; Conf-750902-5) Avail: NTIS HC $4.00

The state of software development via the code DE and the Runge-Kutta code RKF45 (members of a systematic collection called DEPAC) is outlined. The codes are considered as efficient as any for solving non-stiff ordinary differential equations. Author (ERA)

N76-23892# California Univ., Livermore. Lawrence Livermore Lab.

QUALITY SOFTWARE FOR ORDINARY DIFFERENTIAL EQUATIONS AT LLL

A. C. Hindmarsh Mar. 1975 5 p refs Presented at the Natl. Meeting of the Am. Inst. of Chem. Eng., Boston, 7-10 Sep. 1975 Sponsored by ERDA
(UCRL-76671; Conf-750902-2) Avail: NTIS HC $4.00

Work in the area of ordinary differential equations (initial value problem) has been motivated by the study of chemical kinetics systems and the treatment of systems of partial differential equations such as arise in atmospheric models. In both of these the ODE problem is typically stiff. Two general purpose codes, GEAR and EPISODE, are briefly described, along with several variants of them. ERA

N76-23893# California Univ., Livermore. Lawrence Livermore Lab.

SOFTWARE ORGANIZATION FOR A MULTIPURPOSE DESIGN AUTOMATION SYSTEM

R. J. Smith, II and M. N. Matelan 11 Jun. 1975 5 p refs Presented at the IEEE Conf., Washington D. C., 9-11 Sep. 1975 Sponsored by ERDA
(UCRL-76688; Conf-750907-1) Avail: NTIS HC $4.00

The structure of a general-purpose digital design automation system presently being developed and used at the Lawrence Livermore Laboratory is described. Techniques for achieving flexibility are discussed, and design features that reduce development and maintenance costs are identified. Author (ERA)

N76-23894# California Univ., Livermore. Lawrence Livermore Lab.

CONTRIBUTION TO A DEBATE: SHOULD HIGH-LEVEL LANGUAGES BE USED TO WRITE SYSTEMS SOFTWARE

J. G. Fletcher 4 Jun. 1975 9 p refs Presented at the Assoc. of Computing Machinery, Minneapolis, 20-22 Oct. 1975 Spnsored by ERDA
(UCRL-76909; Conf-751014-4) Avail: NTIS HC $4.00

A general discussion of Octopus, one of the largest and most complex information processing facilities in the world, indicates that its system programs assembly language excels in expressive ability, ease of debugging, and efficiency, while it is at least the equal of higher-level languages in freedom from error, clarity and structure, speed and economy of programming, flexibility, provability of correctness, and portability. Author (ERA)

N76-23895# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).

PSF, PROBLEM ORIENTED LANGUAGE FOR TRANSPORT SYSTEMS, LANGUAGE-REPORT

H. J. Guenther, H. Windaver, and W. Werum May 1975 212 p refs In GERMAN
(KFK-PDV-44) Avail: ERDA Depository Libraries HC $13.75

A computer-independent extensible language is described, which allows the user himself to program discrete event-driven processes with problem-oriented formulations. The development of the language took into account the safety and user-control of the programs. The computer-oriented statements (for example alternatives, loops, I/O) are the same as in PEARL. Author (ERA)

N76-23896# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).

COPE, A SET OF PROGRAM BUILDING BLOCKS FOR REAL-TIME OPERATING SYSTEMS

J. Ehrig, H. Hahn, H. Hotes, A. Ibarra, and E. Skrebutis May

1975 100 p refs In GERMAN
(KFK-PDV-40) Avail: ERDA Depository Libraries HC $8.00

Depending on the application, operating systems for process control computers must often be changed, extended, or newly developed. To simplify these tasks a set of functional building blocks for constructing real time operating systems was designed. The programs are organized in layers. The lowest layer consists of hardware dependent basic functions; the middle layer, of functions that are neither hardware, nor application dependent; and the upper layer, of application specific functions. For the transfer of an operating system to another computer or the design of a system for a new application area, only part of the building blocks must be reprogrammed. Author (ERA)

N76-23897# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).

KEDDC, A COMBINED PROCESS COMPUTER PROGRAM SYSTEM FOR THE DESIGN AND APPLICATION OF DDC ALGORITHMS

H. Unbehausen, C. Schmid, F. Boettiger, B. Bauer, and B. Goehring Apr. 1975 86 p refs In GERMAN
(KFK-PDV-37) Avail: ERDA Depository Libraries HC $7.50

The new program system KEDDC described represents a combined process computer program system for the design and application of DDC algorithms. This program system allows the on-line design of industrial plants; and, based on that, the interactive design of optimal controllers; and finally the corresponding process control in DDC operation. The complex program system is built up in modular form. It consists of modules for system identification and design methods as well as higher DDC algorithms. By its comprehensive applicability and by the possibility for on-line modification, the system shows a high degree of flexibility. The program system can be easily implemented on other process computers because of its exceptional independence from the computer and the corresponding executive system using FORTRAN 4. The easy transferability of the system permits the implementation of the program modules in already existing or newly developed program systems for special applications.
Author (ERA)

N76-23898# California Univ., Livermore. Lawrence Livermore Lab.

SIMPLEX, A CODE FOR THE SOLUTION OF LINEAR PROGRAMMING PROBLEMS

H. Walker and L. S. Hall Jun. 1975 55 p refs
(Contract W-7405-eng-48)
(UCRL-51820) Avail: NTIS HC $5.45

A set of procedures is described for solution of a general linear programming problem that seeks to maximize the linear functional W equals/sup n/ SIGMA/sub j equals 1/ c/sub j/x/sub j/ for coordinates x/sub j/ greater than or equal to 0, subject to m restrictions of the form/sup n/SIGMA/sub j equals 1/a/sub ij/x/sub j/ less than or equal to b/sub i/ and l restrictions of the form/sup n/SIGMA/sub j equals 1/ a/sub ij/x/sub j/equals b/sub i/. An LRLTRAN computer code, which performs the maximization, has been developed to follow these procedures and is also described. Illustration of the use of the simplex procedure is given. Author (NSA)

N76-23899# Stanford Univ., Calif. Dept. of Computer Science.

AGGREGATION OF INEQUALITIES IN INTEGER PROGRAMMING

Vaclav Chvatal and Peter L. Hammer Aug. 1975 31 p refs
(Grant NSF DCR-72-03752; NR Proj. 044-402)
(AD-A018461; STAN-CS-75-518) Avail: NTIS CSCL 12/1

Given an m x n zero-one matrix A approximately it is asked whether there is a single linear inequality Ax less than or equal to b whose zero-one solutions are precisely the zero-one solutions of Ax less than or equal to e. An algorithm is developed for answering this question in O(mn sq) steps, and other related problems are investigated. The results may be interpreted in terms of graph theory and threshold logic. GRA

N76-23900# Army Engineer Topographic Labs., Fort Belvoir, Va.

A SYSTEM FOR TOPOGRAPHIC INQUIRY. NO. 5:2 ALPHANUMERIC SUBSYSTEM USERS GUIDE Final Report

Alden C. Gunther Nov. 1975 63 p refs
(AD-A018531; ETL-0031) Avail: NTIS CSCL 09/2

The System for Topographic Inquiry (STOPIN) Alphanumeric Subsystem is an on-line, topographic data system developed to demonstrate the capability to store, retrieve, and disseminate large quantities of nongraphic topographic information. This report explains the language used and the methods employed by the software and provides a guide for using the interactive and batch commands of STOPIN. GRA

N76-23901# System Development Corp., Santa Monica, Calif.

CODS USER GUIDE Special Technical Report, Sep. 1974 - Sep. 1975

K. M. Brandon 14 Nov. 1975 18 p refs
(Contract DAHC15-73-C-0080)
(AD-A018345; SDC-TM-5600/000/00) Avail: NTIS CSCL 09/2

This document describes the use of the Conversion of Data Structures (CODS) system, which can convert and transfer data bases to and from disparate data management systems, using translation languages and the query and generate functions of the data management systems. The system is a research prototype that has been demonstrated and tested. Author (GRA)

N76-23902# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

GUIDE TO THE MANMODSSB COMPUTER PROGRAM

Jeffrey E. Berliner Apr. 1975 44 p refs
(Contract DAAH01-75-C-0158; DA Proj. 1M3-62303-A-214)
(AD-A018360; RD-CR-76-1) Avail: NTIS CSCL 09/2

The MANMODSSB computer program is a computerized implementation of the optimal control model of the human operator for the generation of describing functions. In addition to the frequency domain representation of the human operator there is a time domain subroutine which generates time histories for use in Monte-Carlo simulation. Author (GRA)

N76-23903# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TECHNIQUES OF INTERACTIVE GRAPHICS PROGRAMMING M.S. Thesis

Arthur B. Briggs, Jr. Jun. 1975 153 p refs
(AD-A018330; GSA/MA/72-1) Avail: NTIS CSCL 09/2

Computer interactive graphics provides a method of presenting the output of computer program calculations or data manipulation in graphical instead of tabular form, and allows the program user to modify the parameters of the problem under investigation dynamically. The Control Data Corporation Digigraphics 274 Display Console and 274 Interactive Graphics System software package are typical of computer interactive graphics facilities found on modern computer systems. To demonstrate the feasibility of using computer interactive graphics for education and research, a multiple regression analysis program was converted from a 'batch' mode to interactive graphics use. The program developed during the research, Graphics Interactive Regress (GIR), allows the console operator to vary almost every parameter of the regression interactively, and to examine the results of each dynamically. GRA

N76-23904# Pennsylvania Univ., Philadelphia.

AUTOMATIC GENERATION OF COMPUTER PROGRAMS

N. S. Prymes Sep. 1975 57 p
(Contract N00014-67-A-0216-0014; NR Proj. 049-153)
(AD-A018285; Rept-76-02) Avail: NTIS CSCL 09/2

This is a progress report, as well as an introduction and summary of research on Automatic Program Generation conducted at the Moore School, University of Pennsylvania. The research culminated in two developments. The first is a Module Description Language (MODEL) for functional specification of computer program modules. The second is a MODEL Processor which analyzes the specification, interacts with the user in resolving inconsistencies, ambiguities and incompletenesses, and generates a program for performing the required functions. MODEL has been designed for use by management, business, or accounting specialists who are not required to have computer training. MODEL statements describe input, output, and various formulae. No processing or sequencing information is required

from the user. The operation of MODEL is illustrated in the report with the aid of an example. Author (GRA)

N76-23324* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THEORY, OPERATION, AND COMPUTER PROGRAMMING OF THE 512-LAG CORRELATOR SYSTEM
R. F. Jurgens *In its* The Deep Space Network 15 Apr. 1976 p 164-177 refs (For availability see N76-23304 14-12)
CSCL 09B

N76-23325* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ANALYSIS OF STRUCTURED PROGRAMS. PART 1: KIRCHHOFF'S EQUATIONS
R. J. McEliece *In its* The Deep Space Network 15 Apr. 1976 p 178-187 refs (For availability see N76-23304 14-12)
CSCL 09B

N76-23326* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW CLASS OF BURST-CORRECTING CYCLIC CODES
B. Arazi *In its* The Deep Space Network 15 Apr. 1976 p 188-200 ref (For availability see N76-23304 14-12)
CSCL 09B

N76-23327* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ERROR-MINIMIZING SOFTWARE AUDIT TECHNIQUE
J. C. Holland and W. O. Paine *In its* The Deep Space Network 15 Apr. 1976 p 201-221 ref (For availability see N76-23304 14-12)
CSCL 09B

N76-23328* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY RESULTS OF DSN PERFORMANCE FOR CONVOLUTIONAL CODES WITH A VITERBI DECODER
J. M. Urech, L. D. Vit, and B. D. L. Mulhall *In its* The Deep Space Network 15 Apr. 1976 p 222-240 refs (For availability see N76-23304 14-12)
CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N76-23905 Texas Univ., Arlington.
SUBOPTIMAL CONTROL OF LINEAR REGULATOR Ph.D. Thesis
Ojaswin Laxmikant Desai 1975 94 p
Avail: Univ. Microfilms Order No. 76-11198

The suboptimal control of a linear regulator is investigated, keeping in mind not only the practical engineering constraints but also stable control of the closed loop system. In order to incorporate the constraints, the control is defined as a function of the aggregated state vector which is formed by using an arbitrary aggregation matrix. Such a definition of the control provides flexibility in choosing different combinations of the states to form the aggregated state vector. Other advantages are that it is possible to impose observability constraints, weight the different states, and select the natural modes of the system to suit one's need. With this definition of the control, the feedback law is derived. It is proved that the necessary and sufficient condition for optimality is satisfied. It is also shown that the suboptimal control exists and is unique. Dissert. Abstr.

N76-23906 Auburn Univ., Ala.
DESIGN CONSIDERATIONS IN MODEL REFERENCE ADAPTIVE CONTROL SYSTEMS Ph.D. Thesis
Bruce Kendall Colburn 1975 141 p
Avail: Univ. Microfilms Order No. 76-10892

A general investigation was conducted to develop an analytical procedure for determining the error transient response of model-reference adaptive systems (MRAS). Along this line two major studies are reported. First, a linearized error characteristic equation (LECE) is developed for each of fourteen adaptation techniques, two of which are new and for which asymptotic error stability is proven. These methods are compared through the LECE as to their dominant transient response and general design principles for selecting adaptive gain constants are advanced. A second study results in a general derivation of an exact, extended, nonlinear algebraic stability criterion for a class of MRAS control laws based on Lyapunov's Second Method. Stability boundaries determined using the new criterion and the conventional Lyapunov criterion are analyzed using the LECE approach. Dissert. Abstr.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-23907 British Library Lending Div., Boston Spa (England).
REPRESENTATION OF SOLUTIONS OF BOUNDARY VALUE PROBLEMS FOR SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS BY CONTINUED FRACTIONS BY MEANS OF RECURRENCE RELATIONS
P. I. Bodnarcuk [1975] 11 p refs Transl. into the ENGLISH from Akad. Nauk Ukr. RSR, Dopovidi, Ser A, Fiz.-Teh. Mat. Nauk (Moscow), no. 7, 1971 p 579-583 In ENGLISH and in RUSSIAN
(BLL-M-23829-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Second order differential equations are solved by means of numerical continuous fractions. Boundary value problems are replaced by a system of finite difference equations leading to approximating recurrence relations which give the solutions of the boundary value problems at the points of the interval in which the problems are being considered. Direct solution of the system of equations obtained leads to the solution's being represented at a fixed point in the basic interval by means of continued fractions. Author

N76-23908 British Library Lending Div., Boston Spa (England).
FREQUENCY CHARACTERISTICS OF REGRESSION FILTERS
I. I. Poljak [1975] 14 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 308, 1973 p 51-59 In ENGLISH and in RUSSIAN
(BLL-M-23828-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A general outline of smoothing formula for polynomials of degree 5 or less is presented and their frequency characteristics are derived. Author

N76-23909 Northern Colorado Univ., Greeley.
DECOMPOSITIONS OF TORSION-FREE ABELIAN GROUPS OF FINITE RANK Ph.D. Thesis
Larry Norton Campbell 1975 87 p
Avail: Univ. Microfilms Order No. 76-10830

The theories of finite Abelian groups, p-groups, and torsion groups in general have been yielding almost all their secrets with various powerful results. Consequently, much is known about these groups, and several theorems such as the Fundamental Theorems of Finite and Finitely-Generated Abelian Groups completely describe, up to isomorphism, large classes of these groups. Direct decompositions and the various behaviors they exhibit are examined. The main area of concentration is the finite rank case. Several results are presented showing, for instance, the varied and unpredictable forms various decompositions even the same torsion-free Abelian group may take, and how futile has been the search for almost any sort of uniqueness among these decompositions. Dissert. Abstr.

N76-23910 Northern Colorado Univ., Greeley.
COMPLEX DIFFERENTIATION THEORY BY POWER SERIES METHODS Ph.D. Thesis
France Maurice Evans 1975 119 p
Avail: Univ. Microfilms Order No. 76-10834

The concept of analyticity of complex-valued functions of a complex variable is approached from the power series viewpoint. A function is first defined as analytic at a point z sub 0 if it has a power series expansion valid in a neighborhood of z sub 0. The main purpose of the study is to develop suitable material for use as a supplement in a transitional introduction of functions of a complex variable into or following a conventional calculus course. It is designed to make maximum use of the material on series and power series as developed in the usual calculus sequence. Standard theorems concerning differentiation are all proved without the use of contour integration. By using power series methods, classical theorems about analytic functions and their derivatives can be quickly and easily obtained. These results are natural and intuitive consequences of the results and concepts about power series as presented in traditional calculus courses. Dissert. Abstr.

N76-23911 Oklahoma State Univ., Stillwater.
THE LIMIT-POINT AND LIMIT-CIRCLE CASES OF SECOND AND FOURTH ORDER DIFFERENTIAL EQUATIONS Ph.D. Thesis
David Hartman Taylor 1975 124 p
Avail: Univ. Microfilms Order No. 76-9784

An expository study is made of the limit-point and limit-circle cases of formally self-adjoint differential expressions of the second and fourth order. It assumes a basic knowledge on the part of the reader in differential equations including existence and uniqueness theorems. Basic properties of complex variables are also assumed. The notions of limit-point and limit-circle cases are discussed along with the role played by these notions in eigenfunction expansions of arbitrary functions. Dissert. Abstr.

N76-23912 Pennsylvania State Univ., University Park.
APPLICATIONS OF GENERALIZED FUNCTIONS IN SOLVING BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Ahmad Deeb Alawneh 1975 102 p
Avail: Univ. Microfilms Order No. 76-10701

By considering suitable distributions of Dirac delta function and its distributional derivatives, various boundary value problems of mathematical physics are solved. The fields considered are potential theory, electrostatics, viscous and nonviscous fluids, elasticity and scattering of electromagnetic and acoustic waves. The problems of electrostatic potential, capacity, polarization, electric and magnetic polarizability, virtual mass, translational motion in perfect fluids and torsion of a shaft with cavity are discussed. Their solutions are obtained in a closed form. The components of the polarization and virtual mass tensor for axially symmetric bodies such as spheroids and dumbbell-shaped bodies are derived and used for the evaluation of the far-field amplitude when an electromagnetic wave is incident on these bodies. Dissert. Abstr.

N76-23913 University of South Florida, Tampa.
RANDOM SYSTEMS WITH APPLICATIONS Ph.D. Thesis
Ronald Alan Tourgee 1976 187 p
Avail: Univ. Microfilms Order No. 76-10582

Random or stochastic integral and differential equations occur frequently in the biological, engineering, oceanographic, and physical sciences. This study considers various forms of stochastic integral and differential equations. Brownian motion has been used in a three dimensional setting to determine a diffusion coefficient for a model in chemotherapy. Stability properties of stochastic integral and differential equations are considered. Conditions are found whereby the different forms of these equations satisfy stabilities in the mean, asymptotic type stability, expansive type stability, and contractive type stabilities. In the case of integral equations the method used to verify the findings was mainly admissibility theory. When stochastic differential equations were considered, the method employed stochastic Lyapunov functions with the comparison principle. The work concerning stochastic integral equations of J. S. Milton and C. P. Tsokos was extended, and the deterministic work in differential equations of V. Lakshmikantham and C. P. Tsokos has been extended to a stochastic setting. Dissert. Abstr.

N76-23914 Vermont Univ., Burlington.
CONVERGENCE INVESTIGATIONS OF PARABOLIC AND HYPERBOLIC FINITE ELEMENT FORMULATIONS Ph.D. Thesis
Edward Michael Buturla, Jr. 1976 156 p
Avail: Univ. Microfilms Order No. 76-11868

The convergence characteristics of two-dimensional parabolic and hyperbolic finite element formulations are investigated. To this end, a new functional expressed in terms of general functions is introduced. Certain choices of the general functions are shown to yield the Euler-Lagrange equations for the parabolic and hyperbolic problems. Different choices are then shown to yield the appropriate finite element matrix equations. The functional is used to prove convergence of the finite element solution towards the exact solution. The proofs of convergence include the effects of the singularities at the corners of the two-dimensional plate. Time integration effects on the error are included in a general sense which separates the time integration error from the error due to the finite element approximations. Numerical techniques for solving the two-dimensional finite element wave propagation equations are also investigated. A number of integration methods are investigated to find a technique most suitable for the problem. Dissert. Abstr.

N76-23915 Colorado Univ., Boulder.
IMPLEMENTATION OF THREE DIMENSIONAL THEORIES OF CONSOLIDATION Ph.D. Thesis
Herbert Lee Martin 1975 125 p
Avail: Univ. Microfilms Order No. 76-11594

Derivations of three-dimensional consolidation theory and pseudo three-dimensional consolidation theory are presented. Physical constants are discussed and laboratory tests for their determination are proposed. A variational principle and a finite element method of solution are presented for three-dimensional and pseudo three-dimensional theories. Computer programs for analysis of consolidation problems in plane strain and axial symmetry using the finite element method are outlined. These programs are verified by comparison with analytical and numerical solutions. The versatility of three-dimensional consolidation theory and of the finite element method is demonstrated with the solution of the rigid rough footing problem. Dissert. Abstr.

N76-23916 Cornell Univ., Ithaca, N.Y.
A FINITE ELEMENT METHOD FOR THE TRICOMI PROBLEM IN THE ELLIPTIC REGION Ph.D. Thesis
John Arthur Trangenstein 1975 104 p
Avail: Univ. Microfilms Order No. 76-9572

The Tricomi problem is mixed elliptic, parabolic and hyperbolic, with data given on a curve sigma in the region $y > 0$ and on a characteristic gamma for $y < 0$. By imposing the Darboux formula, which relates u(x,0), u sub y(x,0) and the data on the characteristic, we generate an elliptic problem with a non-local boundary condition on a line of parabolic degeneracy; the solution of this elliptic problem is the solution of the Tricomi problem for $y > 0$. This elliptic problem is shown to be well-posed by converting it into an equivalent variational problem and applying the Lax-Milgram theorem. The analysis is performed in weighted Sobolev spaces; and several properties of these spaces, especially the analogues of the Rellich lemma, the Sobolev lemma, and the Bramble-Hilbert lemma on approximation by piecewise polynomials are discussed and proved. Dissert. Abstr.

N76-23917 New York Univ., N.Y.
A PROBABILISTIC APPROACH TO THE ASYMPTOTIC DEVELOPMENT OF APPROXIMATE SOLUTIONS OF INITIAL AND BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Walter Vasilaky 1975 75 p
Avail: Univ. Microfilms Order No. 76-10236

For the initial-value problem we obtain an asymptotic expansion in terms of a small parameter of an approximate solution to a second order linear parabolic equation. The approximate solution is determined by way of a transition operator of a Markov chain, which plays the role of a difference operator. For the boundary value problem, an asymptotic expansion is obtained up to the first order term of an approximation solution

to a second order linear elliptic equation. In characterizing the boundary values of the first order term in the expansion, a problem of a boundary layer arises. Dissert. Abstr.

N76-23918 British Library Lending Div., Boston Spa (England).
AN APPLICATION OF THE LAPLACE TRANSFORMATION TO THE SOLUTION AND INVESTIGATION OF THE STABILITY OF LINEAR DIFFERENTIAL EQUATIONS WITH VARIABLE COEFFICIENTS AND TIME-LAGS
K. G. Valeev Feb. 1976 43 p refs Transl. into ENGLISH from Tr. Seminara po Teory Differentsialnykh Cravneii s Otkonyay-ashchinsya Argumentom, no. 4, 1967 p 51-78
(BLL-RTS-10082) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 40 BLL photocopy coupons

Some classes of linear differential equations with variable coefficients or variable time-lags were studied. The essence of the method is first to discover the Laplace transform of the solution of the system of differential equations; the transform can be obtained as a system of linear functional equations or as a series, which must in certain cases be continued analytically into the given domain. The transform is obtained in the form of a matrix series which is used to obtain the original. As the independent variable approaches infinity, the behavior of the dependent variable is closely defined by the singular points of the Laplace transform. Some examples are considered. Y.J.A.

N76-23919# Cornell Univ., Ithaca, N.Y.
A GENERALIZED STEADY STATE METHOD FOR STIFF EQUATIONS
J. W. Hiestand (Combust. Eng., Chattanooga) and A. R. George 12 Apr. 1976 46 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1976
(Contract F44620-60-C-0063)
Avail: NTIS HC $4.00

A method is presented for obtaining numerical solutions to stiff equations characterized by weak coupling among the dependent variables. It is therefore especially suited to systems describing chemical reactions. The method is a generalization of the steady state approximation and is interpreted in terms of matched asymptotic expansions. A simple yet reliable means for identifying those variables whose values may be obtained approximately is provided, with a direct estimate of the resulting error continuously possible. No detailed a priori understanding of the system analyzed is necessary, while different applications require little modification of the basic technique. Application is made to a reacting hydrogen-air system and to a simplified photochemical smog model with significant savings in computer time. Author

N76-23920*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
C SUPER 1: COMPATIBLE INTERPOLATION OVER A TRIANGLE
C. L. Lawson 1 May 1976 39 p refs
(Contract NAS7-100)
(NASA-CR-147946; JPL-TM-33-770) Avail: NTIS HC $4.00 CSCL 12A

An elementary derivation and a complete description is given of an algorithm for interpolation over a plane triangle when function values and first partial derivatives are given at the vertices. The method gives C1 continuity with neighboring triangles. The interpolation method is mathematically equivalent to one that has been discussed previously in the literature; however, the algorithmic form given here is more efficient than has previously been described. Author

N76-23921# Oak Ridge National Lab., Tenn.
KWIC INDEX FOR NUMERICAL ALGEBRA
A. S. Householder Jun. 1975 627 p Revised
(Contract W-7405-eng-26)
(ORNL-4778-Rev) Avail: NTIS HC $13.60

This listing combines, updates, and otherwise augments all previously issued volumes. The intention was to list recent literature and selected older classics that have a possible interest for those working in this branch of numerical analysis. Author (ERA)

N76-23922# State Univ. of New York, Buffalo. Statistical Science Div.
MULTIPLE TIME SERIES, DETERMINING THE ORDER OF APPROXIMATING AUTOREGRESSIVE SCHEMES
Emanuel Parzen Jul. 1975 28 p refs
(Contract N00014-72-C-0508; NR Proj. 042-234)
(AD-A018357; TR-23) Avail: NTIS CSCL 12/1

Three aims of the time series analysis can be distinguished of a finite sample Y(t), t = 1,2,..., T of a univariate or multivariate time series: (1) Spectral analysis, (2) Model identification, and (3) Prediction. In this paper we consider the case in which a joint autoaggressive scheme is a multiple time series which is stationary, normal, and zero mean. We describe an approach to the solution of these problems of time series analysis through a criterion called CAT (an abbreviation for criterion autoregressive transfer-function). CAT enables one to choose the order of an approximating autoregressive scheme which is 'optimal' in the sense that its transfer function is a minimum overall mean square error estimator (called (ARTFACT) of the infinite autoregressive transfer function (ARTF) of the filter which transforms the time series to its innovations (white noise). Algorithms for choosing the order of an ARTFACT (autoregressive transfer function approximation converging to the truth) enables one to carry out the approach to empirical multiple time series analysis introduced in Parzen (1969), in particular autoregressive spectral estimation of the spectral density matrix of a stationary multiple time series. Such estimators for univariate time series have been very successfully applied in geophysics (see Ulrych and Bishop (1975)) where they are called 'maximum entropy spectral estimators.' This paper provides a basis for an extension of these procedures to multiple time series. GRA

N76-23923# Aerospace Corp., El Segundo, Calif.
NONLINEAR RECURSIVE ESTIMATION OF A MOVING TARGET
Kenneth K. Wong 15 Sep. 1975 9 p refs
(Contract F04701-75-C-0076)
(AD-A018467; TR-0076(6901-03)-3; SAMSO-TR-75-280)
Avail: NTIS CSCL 12/1

This report considers the application of a Bayesian nonlinear recursive filter for optimal position estimation of a moving target from sampled intensity data. The a posteriori probability density is calculated recursively. The optimal estimator may either be the conditional mean (minimum variance) or the maximum a posteriori. Author (GRA)

N76-23924# Washington Univ., Seattle. Dept. of Mathematics.
A d-PSEUDOMANIFOLD WITH f(SUB o) VERTICES HAS AT LEAST df(SUB o)-(d MINUS 1) (d PLUS 2) d-SIMPLICES
Victor Klee Sep. 1975 16 p refs
(Contract N00014-67-A-0103-0003; NR Proj. 044-353)
(AD-A018433; TR-56) Avail: NTIS CSCL 12/1

Barnette was the first to prove that if (f sub k) is the number of k-faces of a simple (d-1)-polytope P then (*) (F sub 0) greater than or equal to d(f sub d) - (d-1) (d-2). He later extended (*) to a graph-theoretic setting and was thereby enabled to prove the dual inequality for triangulated d-manifolds. Here his methods are used to provide a different graph-theoretic extension of (*) and thus extend the dual inequality to simplicial d-pseudomanifolds. GRA

N76-23925# Naval Postgraduate School, Monterey, Calif.
IRREDUCIBILITY OVER THE RATIONALS M.S. Thesis
Edward Cass Traasdahl Sep. 1975 80 p refs
(AD-A018323) Avail: NTIS CSCL 12/1

A brief historical survey indicates the type of general irreducibility criteria that are sufficient for irreducibility over the rationals. Three general approaches to the problem are then examined in turn. The first of these involves an application of ideal theory for number fields, the second a construction of Newton polygons for which an appropriate multiplication theorem holds and the last a method for constructing non-Archimedean values on the field of fractions of the ring of polynomials over the rationals from which irreducibility criteria can be deduced. The conclusion summarizes the nature of these attempts. GRA

N76-23321* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO METHODS FOR REDUCING THE NUMBER OF

MULTIPLICATIONS IN COMPLEX FAST FOURIER TRANSFORMS
D. E. Wallis *In its* The Deep Space Network 15 Apr. 1976 p 123-138 refs (For availability see N76-23304 14-12)
CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

No abstracts in this category.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-23926 Brown Univ., Providence, R.I.
THE SYSTEM FOR SYSTEMS DEVELOPMENT Ph.D. Thesis
Richard Daniel Bergeron 1973 214 p
Avail: Univ. Microfilms Order No. 75-12472

The System for System Development (SSD) is an attempt to provide a unified and cohesive array of tools that encompass all phases of system implementation from original compilation through updating, testing, and documentation. The major components of SSD include a compiler for the systems programming language, LSD, a linkage editor, a debugging package, documentation facilities and a communications system that is used for sharing of information among all the other components. The primary goal of the entire system is oriented toward improving the reliability of the system being implemented without excessively degrading its resource utilization. Consequently the facilities provided are all designed to facilitate the debugging process. Dissert. Abstr.

N76-23927 Mississippi State Univ., State College.
CONSTRAINED SHORTEST PATHS IN NETWORKS Ph.D. Thesis
Chi-Hung Shek 1975 208 p
Avail: Univ. Microfilms Order No. 76-4875

Shortest path problems in networks constitute a branch of optimization theory wherein system network models with paths which are characterized by path lenghts are of concern. This work is an extension of the classical shortest path problem; here additional cost constraints are imposed on the network model. A dynamic programming solution approach is first formulated. It is solved by an iterative scheme in which the cost bound variable is incremented by a unit at the end of each iteration where the shortest paths with path cost not exceeding the cost bound variable are found. The concept of stepping cost is introduced representing the path cost at which a change of shortest path length occurs. A theorem is proved on the procedure to locate the immediate stepping cost and the associated stepping-cost path length; thus, an acceleration of the iterative scheme is feasible. As a result, a combinatorial algorithm is developed with computational effort being the order of the square of the number of stepping costs. Further extensions to networks with more than one path cost constraint are presented. The constrained shortest path algorithms are applied to flow networks and to networks with probabilistic weighted branch costs. FORTRAN computer programs are given to implement the algorithms. Dissert. Abstr.

N76-23928 State Univ. of New York, Buffalo.
ON AGGREGATION OF LARGE-SCALE LINEAR DYNAMIC SYSTEMS Ph.D. Thesis
Beyong Woo Yoo 1975 206 p
Avail: Univ. Microfilms Order No. 76-9137

The aggregation of linear large-scale dynamic systems is examined and a two-step approach is proposed. In this procedure, the aggregated system consists of two subsystems. The first subsystem represents aggregation through the retainment of dominant eigenvalues of the original system, leading to a first approximation of the desired output of the original system. The purpose of augmenting it with a second subsystem is to provide an estimation of the error in the first approximation, thus permitting a second correction to the output approximation and resulting in an output approximation of greater accuracy. Two optimization techniques are discussed for the determination of unknown parameters in the aggregated systems. These techniques use minimization principles of certain suitable performance indices and are developed for both single input-single output and multiple input-multiple output systems. Numerical examples illustrating these procedures are given and the results are compared with those obtained using existing methods. Finally, a pharmacokinetics problem is studied from the aggregation point of view.
Dissert. Abstr.

N76-23929 Northwestern Univ., Evanston, Ill.
THE POSTMAN PROBLEM Ph.D. Thesis
Charles Hamilton Kappauf 1975 199 p
Avail: Univ. Microfilms Order No. 76-11900

The postman problem can be formulated as an integer linear programming problem. The Chinese postman problem and the directed postman problem can be solved exactly. Essential to the characterization and solution of the mixed postman problem is the notion of an assigned Euler network. An assigned Euler network is related to a given network by copying the edges and arcs of the network and assigning a direction to the edges as directed by a given postman tour. In the resulting assigned Euler network, an Euler tour corresponds to the given postman tour. A specified postman tour yields a unique assigned Euler network. It is shown that any assigned Euler network along its generating postman tour can be reduced to a minimum length Euler network, with respect to the original network.
Dissert. Abstr.

N76-23930 Arizona Univ., Tucson.
OPTIMAL CONTROL THEORY IN THE LONG TERM MANAGEMENT OF ECOLOGICAL SYSTEMS Ph.D. Thesis
Cho Seng Lee 1975 143 p
Avail: Univ. Microfilms Order No. 76-11323

Three subclasses of the general infinite time horizon optimal control problem are examined. They are the class of steady state optimal control problems, the class of optimal periodic control problems with period specified, and the class of optimal periodic control problems with period unspecified. In considering optimal periodic control problems, the average cost concept is introduced, and two theorems concerning the existence of a periodic solution for a general control system are stated and proved. In order to obtain some necessary conditions for both the specified and unspecified period optimal periodic control problems, additional state variables are introduced and the problems recast into the form of a standard optimal control problem. A sufficiency theorem is stated and proved for the class of optimal periodic control problems with period specified.
Dissert. Abstr.

N76-23931 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SENSITIVITY OPERATORS AND ASSOCIATED SYSTEM CONCEPTS FOR LINEAR DYNAMIC SYSTEMS Ph.D. Thesis
Jarve Gary Reid 1975 211 p
Avail: Univ. Microfilms Order No. 76-10089

Output parameter sensitivity for linear dynamic systems is treated in an operator framework. Parameter sensitivity is derived for a general linear system defined as the sum of linear operators on the initial state and control input. The sensitivity-related properties of insensitivity, sensitivity controllability, parameter identification and identifiability, and optimal control design for both minimum sensitivity and improved identification are then dealt with in terms of the sensitivity operators and their adjoints. This theoretical foundation is applied to give fundamental descriptions of the parameter sensitivities in linear ordinary differential equation systems. The discussion focuses on linear time-invariant systems where a new algebraic representation of the parameter sensitivities is obtained. This representation shows

the essential way in which the eigenvalue sensitivities are related to the modes in the sensitivity operators. Dissert. Abstr.

N76-23932# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
HARDWARE EXTENDED EXECUTIVE PRIMITIVES FOR PROCESS CONTROL SYSTEMS
J. Nehmer and O. Eggenberger Jun. 1975 101 p refs In GERMAN
(KFK-PDV-49) Avail: ERDA Depository Libraries HC $8.25

A structuring concept for real-time operating systems, a set of elementary operating system functions defined within the framework of the structure, and a related real-time software production system are described. Author (ERA)

N76-23933# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
SOME VALID INEQUALITIES FOR THE SET PARTITIONING PROBLEM Research Report
Egon Balas Jul. 1975 47 p refs
(Contract N00014-67-A-0314-0007; Grant NSF GP-37510; NR Proj. 047-048)
(AD-A018379; RR-368) Avail: NTIS CSCL 12/2

The author introduces a family of inequalities derived from the logical implications of set partitioning constraints and investigates their properties and potential uses. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-23934 Notre Dame Univ., Ind.
QUASI-ISOMORPHIC ABELIAN GROUPS AND THEIR TENSOR PRODUCTS Ph.D. Thesis
Paul Jeffrey Bernard 1976 79 p
Avail: Univ. Microfilms Order No. 75-10513

The notion of quasi-isomorphism of Abelian groups is investigated with respect to the behavior of quasi-isomorphic groups under the tensor product. In particular, it is determined whether quasi-isomorphism of two Abelian groups is preserved under tensoring by a third group, and under what conditions an isomorphism of the tensor products will be obtained. These questions are answered quite completely except in the most general case, when all of the groups involved are mixed and non-splitting; although a few partial results are obtained in this direction. Dissert. Abstr.

N76-23935 Maryland Univ., Baltimore.
DYNAMICAL FLOWS NEAR COMPACT SETS ERGODICITY AND CONTINUITY OF LIMIT SET MAPS Ph.D. Thesis
Masahiro Nishihama 1976 110 p
Avail: Univ. Microfilms Order No. 76-10628

A dynamical system near an isolated compact set is considered and a necessary and sufficient condition for the existence of a scalar function (called a Lyapunov Function) which is monotone along orbits in an invariant neighborhood of the isolated compact set. As a special case, a flow near an isolated critical point defined by a two-dimensional autonomous system is considered. The existence of an invariant measure near the isolated critical point is demonstrated which is expressed in terms of a non-negative continuous function defined by the differential system. The continuity of set-valued maps for semi-dynamical systems is then investigated in which the positive orbit closure, positive limit set, positive prolongation and positive prolongational limit set of x are represented. Dissert. Abstr.

N76-23936 South Carolina Univ., Columbia.
KERNELS OF REGULAR SEMIGROUP HOMOMORPHISMS Ph.D. Thesis
Ruth Isabella Schulmann Feigenbaum 1975 64 p
Avail: Univ. Microfilms Order No. 76-10453

Any congruence on a semigroup S with nonempty set E of idempotents induces a partition of the set E. For example, the identity congruence i induces the partition P sub i(E) = [e : e union E] while the universal congruence Omega induces the partition P sub 2(E) = [E]. For an inverse semigroup S, it is shown that those partitions of E satisfying certain normality conditions are induced by congruences on S; in particular the smallest congruence Sigma and the largest congruence Rho corresponding to such a partition of E are described. The descriptions of Sigma and Rho corresponding to a given normal partition S which induce this partition of E are given. These results have been generalized to the class of orthodox semigroups. The results for the class of regular semigroups are presented. Dissert. Abstr.

N76-23937 Utah Univ., Salt Lake City.
PRODUCTS OF FINITE SIMPLE GROUPS Ph.D. Thesis
Gary Lee Walls 1975 65 p
Avail: Univ. Microfilms Order No. 76-11866

Groups which can be written as the product of two non-Abelian simple groups are studied. If G = AB where A,B are simple groups then every proper normal subgroup of G is solvable, at least in the case where G contains no simple subgroups with non-solvable outer-automorphism groups. Using this and related results, all of the finite groups which are the product of two simple groups and have Sylow 2-subgroups of order less than or equal to 32 are described. All groups which are the product of two simple groups whose Sylow 2-subgroups are dihedral of order eight are also described. This result enables the possible products of some particular simple groups to be described, for example: all finite groups G = AB, where A, B are isomorphic to the alternating group of degree 6 or 7, or the projective special linear group of degree 2 over a field with 7 elements. Dissert. Abstr.

N76-23938 Cornell Univ., Ithaca, N.Y.
ISOMORPHISM PROBLEMS INVOLVING PLANAR GRAPHS Ph.D. Thesis
Jin Kue Wong 1975 64 p
Avail. Univ. Microfilms Order No. 76-9580

Isomorphism problems involving planar graphs are examined using a theory of algorithms approach. It is shown that the planar subgraph isomorphism problem is NP-complete even in the case where the subgraph is restricted to being a tree and the supergraph restricted to being planar. The main result documented, however, is a new algorithm for planar graph isomorphism. This algorithm runs on a random access machine in worst-case time linear in the total number of vertices in the graphs for which isomorphism is to be determined. Dissert. Abstr.

N76-23939# Washington Univ., Seattle. Dept. of Mathematics.
UNIQUE REDUCIBILITY OF SUBSETS OF COMMUTATIVE TOPOLOGICAL GROUPS AND SEMIGROUPS
Victor Klee and David Gale Sep. 1975 44 p refs
(Contract N00014-67-A-0103-0003; NR Proj. 044-353)
(AD-A018512; TR-51) Avail: NTIS CSCL 12/1

As the term is used here, a reduction of a set is a direct sum decomposition into indecomposable summands. The main goal is to find conditions under which reductions are literally unique, but weaker sorts of uniqueness (akin to that of the Krull-Schmidt theorem) are also considered. The problem of unique reducibility is a classical one in many contexts, but our approach - particular, its exploitation of the key geometric notion of extreme point in conjunction with combinatorial methods involving the refinement property - appears to be new. Special cases of the main result have been obtained by Isbell in studying factorizations of Banach spaces and by Heller in studying stochastic automata. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-23940 British Library Lending Div., Boston Spa (England).
THE EFFECT OF A MAGNETIC FIELD ON WATER
D. Ocepek Mar. 1976 24 p refs Transl. into ENGLISH from Rudarsko-Met. Zbornik (Ljubljana), no. 1-2, 1973 p 83-93
(BLL-RTS-10059) Avail: British Library Lending Div.,

Boston Spa, Engl.: £10.00; 16 photocopy coupons

Most of the technological effects of magnetic water can be attributed to a decrease in surface tension of the water and decreased wetability of the soild phase due to a larger contact angle of the solid/liquid phase boundary. There is also a marked change of zeta potential in the system investigated owing to changes in the charges of the dissociated ions. The practical result of these phenomena is accelerated flocculation and improved settling of, for instance, a kaolin suspension. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-23941 British Library Lending Div., Boston Spa (England).
DEADENING OF NOISE IN RELEASE LOCATIONS
Guy Peignelin [1975] 22 p refs Transl. into ENGLISH of report from French Conf. Presented at conf. held by Assoc. Tech. of the Gas Ind. in France, Paris, 10-24 Apr. 1974
(BLL-ESB-Trans-589-(3810.97)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The problems bound up in environment are assuming increasing importance in our present society and in particular, those concerned with nuisance resulting from noise. In fact, these affect an organism at the one and the same time from both the physiological aspect (nascent deafness) and from the psychological and physiosociological aspect (feverishness, irritability and even distress). An examination is made of industries which could be the sources of noise, and solutions to reduce noise and to eliminate it are presented. The releasing of gas is studied. Sources of noise, transmission methods, and possible remedies are discussed. Author

N76-23942* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PUBLICATIONS IN ACOUSTICS AND NOISE CONTROL FROM THE NASA LANGLEY RESEARCH CENTER DURING 1940 - 1974
Goldie C. Smith, comp. and Jean N. LaNeave, comp. Jul. 1975 71 p refs
(NASA-TM-X-72710) Avail: NTIS HC $4.50 CSCL 20A

This document contains reference lists of published Langley Research Center papers in various areas of acoustics and noise control for the period 1940-1974. The research work was performed either in-house by the center staff or by other personnel supported entirely or in part by grants or contracts. The references are listed chronologically and are grouped under the following general headings: (1) Duct acoustics, (2) Propagation and operations, (3) Rotating blade noise, (4) Jet noise, (5) Sonic boom, (6) Flow-surface interaction noise, (7) Human response, and (8) Structural response. Author

N76-23943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC LINER OPTIMUM IMPEDANCE FOR SPINNING MODES WITH CUT-OFF RATIO AS THE DESIGN CRITERION
Edward J. Rice 1976 11 p refs Proposed for presentation at the Third Aero-Acoustic Conf., Palo Alto, Calif., 20-23 Jul. 1976; sponsored by AIAA
(NASA-TM-X-73411; E-8741) Avail: NTIS HC $3.50 CSCL 20A

A new acoustic liner design procedure based upon model cut-off ratio is outlined. Proposed experiments to substantiate this design procedure are outlined. Author

N76-23944*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
WAVE THEORY OF TURBULENCE IN COMPRESSIBLE MEDIA Final Report
Czeslaw P. Kentzer Washington NASA May 1975 118 p refs
(Grant NGR-15-005-174)
(NASA-CR-2671; Rept-75-2) Avail: NTIS HC $5.50 CSCL 20A

An acoustical theory of turbulence was developed to aid in the study of the generation of sound in turbulent flows. The statistical framework adopted is a quantum-like wave dynamical formulation in terms of complex distribution functions. This formulation results in nonlinear diffusion-type transport equations for the probability densities of the five modes of wave propagation: two vorticity modes, one entropy mode, and two acoustic modes. This system of nonlinear equations is closed and complete. The technique of analysis was chosen such that direct applications to practical problems can be obtained with relative ease. Author

N76-23945*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOUND SCATTERING BY RIGID OBLATE SPHEROIDS, WITH IMPLICATION TO PRESSURE GRADIENT MICROPHONES
Algirdas Maciulaitis, John Seiner, and Thomas D. Norum Washington May 1976 42 p refs
(NASA-TN-D-8140; L-10592) Avail: NTIS HC $4.00 CSCL 20A

The frequency limit below which sound scattering by a microphone body is sufficiently small to permit accurate pressure gradient measurements was determined. The sound pressure was measured at various points on the surface of a rigid oblate spheroid illuminated by spherical waves generated by a point source at a large distance from the spheroid, insuring an essentially plane sound field. The measurements were made with small pressure microphones flush mounted from the inside of the spheroid model. Numerical solutions were obtained for a variety of spheroid shapes, including that of the experimental model. Very good agreement was achieved between the experimental and theoretical results. It was found that scattering effects are insignificant if the ratio of the major circumference of the spheroid to the wavelength of the incident sound is less than about 0.7, this number being dependent upon the shape of the spheroid. This finding can be utilized in the design of pressure gradient microphones. Author

N76-23946# MAN-Acoustics and Noise, Inc., Seattle, Wash.
ESTABLISHING NOISE CRITERIA FOR RESIDENTIAL LIVING IN AREAS SURROUNDING COMMERCIAL AVIATION AIRPORTS Final Report
Nov. 1975 68 p refs
(Contract DOT-FA74WAI-439)
(AD-A021683/8; MAN-1011; FAA-RD-75-211) Avail: NTIS HC $4.50 CSCL 20/1

Four different airport noise conditions were simulated. Three conditions involved day flights of 150 aircraft with average Noise Exposure Forecast (NEF) values of 36.9, 32.5, and 26.9. The fourth condition added 18 night flights which resulted in a mean NEF of 32.9. Interference with daily living activities and annoyance responses to the four conditions were obtained. Some of the results and conclusions are: (1) interference with daily living activities and annoyance decreased as total noise level decreased and interference and general annoyance was highest in the evening period; (2) results indicated that the 10 db penalty for night flyovers is too large; and (3) with the reservation that unique features of particular airports require consideration when applying noise criteria, it is concluded that a noise exposure forecast of 32 to 33 that includes nighttime flights is compatible with residential living. Author

N76-23947*# Hersh Acoustical Engineering, Chatsworth, Calif.
FLUID MECHANICAL MODEL OF THE ACOUSTIC IMPEDANCE OF SMALL ORIFICES Final Report
Alan S. Hersh and Thomas Rogers Washington NASA May 1976 57 p refs
(Contract NAS3-17858)
(NASA-CR-2682) Avail: NTIS HC $4.50 CSCL 20A

A fluid mechanical model of the acoustic behavior of small orifices is presented which predicts orifice resistance and reactance as a function of incident sound pressure level, frequency, and orifice geometry. Agreement between predicted and measured values is excellent. The model shows the following: (1) The acoustic flow in immediate neighborhood of the orifice can be modeled as a locally spherical flow. Within this near field, the flow is, to a first approximation, unsteady and incompressible.

(2) At very low sound pressure levels, the orifice viscous resistance is directly related to the effect of boundary-layer displacement along the walls containing the orifice, and the orifice reactance is directly related to the inertia of the oscillating flow in the neighborhood of the orifice. (3) For large values of the incident acoustic pressure, the impedance is dominated by nonlinear jet-like effects. (4) For low values of the pressure, the resistance and reactance are roughly equal. Author

N76-23948# New York Univ., N.Y.
NONLINEAR GEOMETRICAL ACOUSTICS
Brian R. Seymour and Michael P. Mortell 1975 65 p refs (Contract DA-ARO(D)-31-124-72-G47)
(AD-A018315; ARO-5669.32-M) Avail: NTIS CSCL 20/1

The development of the theory of nonlinear wave propagation in both bounded and semi-infinite dissipative media is followed from its origins in the theories of linear geometrical acoustics, simple waves, and acceleration fronts. In Part I, Sections 2 to 5, we consider examples in which only one component wave is excited and describe the effects of three types of dissipative mechanisms on unidirectional waves. In Part II, Sections 6 to 9, we consider nonlinear waves in media of finite extent. In general, more than one component wave is excited. The coupling between the interaction and distortion of the different components is described. The effect of radiation from the boundaries is included for both transient and forced, time-periodic motions. GRA

N76-23949# Naval Underwater Systems Center, New London, Conn.
PROJECT KIWI ONE: LOW FREQUENCY SOUND ATTENUATION MEASUREMENTS IN THE SOUTH PACIFIC OCEAN
D. G. Browning, W. R. Schumacher, R. W. Bannister, and R. N. Denham 1 Jun. 1975 39 p refs Prepared in cooperation with Defence Scientific Establishment
(SF52552702)
(AD-A018291; NUSC-TR-4949) Avail: NTIS CSCL 20/1

Project KIWI ONE was conducted jointly by the New Zealand Defence Scientific Establishment and the United States Naval Underwater Systems Center to determine the attenuation of sound in the Pacific Ocean at frequencies below 10,000 Hz. It was determined that for frequencies of interest to Fleet sonar operation, the measured value of attenuation in the Pacific Ocean is significantly less than that measured in the Atlantic Ocean or the Mediterranean Sea. Author

N76-23950# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
ACOUSTICAL RADIATION FROM PERIODICALLY STIFFENED MEMBRANE EXCITED BY TURBULENT BOUNDARY LAYER Interim Report, Feb. 1973 - Aug. 1974
Yi Mason Chang Apr. 1975 51 p refs
(Contract N00014-67-A-0204-0002; SR0090101)
(AD-A018425; A/V-70208-11) Avail: NTIS CSCL 20/1

Characteristics of periodically stiffened membrane are studied by using a string model loaded with equally-spaced mass and rotary inertia. The acoustical radiation by periodically stiffened membrane excited by a turbulent boundary layer is estimated using a modal analysis on an individual bay of membrane between stiffeners. Two theoretical predictions of radiated sound power are made using statistical energy methods. One is based upon measured wall pressure data, the other upon measured vibratory response of the membrane. Both agree well with direct measurements of radiated sound power. GRA

N76-23951# Wyle Labs., Inc., El Segundo, Calif.
COMMUNITY NOISE COUNTERMEASURES COST-EFFECTIVENESS ANALYSIS Final Report
Robert Rackl, Louis Sutherland, and Jack Swing Jul. 1975 333 p
(PB-247080/5; WCR-75-2) Avail: NTIS HC $10.00 CSCL 20A

An analytical model of a typical community is developed for the purpose of carrying out a cost-effectiveness analysis of various outdoor noise countermeasures. The principal elements of the model are data base describing the community's geography, population distribution, and typical building construction; a data base describing the location and strength of noise sources; energy summation of noise levels from each source at many locations; and use of noise level versus human response transfer functions to determine the number of people adversely affected by this noise level. Summing these for the whole community and dividing by the total population results in a Noise Impact Index indicating the quality of the noise environment. Three basic types of countermeasures are applied: source reduction, source rerouting, and path-receiver treatments. GRA

N76-23952# Denver Research Inst., Colo. Div. of Mathematical Sciences.
NON-UNIQUENESS IN THE INVERSE SOURCE PROBLEM IN ACOUSTICS AND ELECTROMAGNETICS
Norman Bleistein and Jack K. Cohen Nov. 1975 37 p refs (Contracts N00014-76-C-0039; N00014-76-C-0079; NR Proj. 083-364; NR Proj. 041-434)
(AD-A019510; MS-R-7609) Avail: NTIS CSCL 20/1

It is shown that there exist physically realizable acoustic and electromagnetic sources for which the radiated field is exactly zero. Alternative analytical characterizations of these non-radiating sources are presented. Recently developed formulations of the inverse problem in acoustics and electromagnetics are introduced. The source is given as a solution of a Fredholm integral equation of the first kind. It is shown that the null space for this integral equation in each case is the class of non-radiating sources. GRA

N76-23953# National Bureau of Standards, Washington, D.C. Applied Acoustics Section.
AN OUTDOOR NOISE MONITORING SYSTEM WITH AUTOMATIC CALIBRATION AND REMOTE DIGITAL DISPLAY Final Report
D. S. Blomquist, J. S. Forrer, and D. M. Corley Oct. 1975 11 p
(PB-247639/8; NBSIR-75-962) Avail: NTIS HC $3.50 CSCL 20A

A monitoring system for outdoor noise is described. The system uses a microprocessor for automatic calibration. The design concepts of the system are applicable to other remote noise monitoring systems. GRA

N76-23954# Army Electronics Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.
ACOUSTIC SURFACE WAVE FABRICATION TECHNIQUES AND RESULTS
W. J. Skudera, Jr. and G. LeMeune Aug. 1975 28 p refs
(DA Proj. 1S7-62705-AM-94)
(AD-A018666; ECOM-4333) Avail: NTIS CSCL 20/1

Various procedures and techniques have been established to fabricate surface wave devices in the 30 to 150 MHz frequency range. The type of surface wave devices fabricated include delay lines, bandpass filters and pulse compression filters. Emphasis was placed on developing a simple procedure having reasonable yield so that a given model could be successfully fabricated using a minimum of acoustic substrates, with a minimum of fabrication time and effort. The devices were evaluated and compared, where possible, to outside laboratory results. Author (GRA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-23955 British Library Lending Div., Boston Spa (England).
A PROCEDURE FOR CALCULATING AND INTERPRETING CURVES FOR THE RADIAL DISTRIBUTION OF ATOMS IN MOLTEN THREE-COMPONENT SUBSTANCES
Ya. I. Dutchak, V. S. Frenchko, and O. M. Voznyak [1975] 8 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (Moscow), no. 7, 1975 p 124-127
(BLL-M-25259-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Several models of the structures of molten three component

systems are considered: quasi-eutectic, statistical distribution of atoms model, and polystructural. Analytical expressions are given for the area beneath the first maximum on the curve for the radial distribution of atoms, for several variations of the polystructural model. The example of molten In-Ga-Ag and Bi-Cd-Sn eutectics is used for proving the possibility of evaluating the nature of atomic ordering in molten three component substances by verifying the models considered. Author

N76-23956 Boston Univ., Mass.
AN EXPERIMENTAL STUDY OF ELASTIC ELECTRON-ATOM SCATTERING AND RESONANCE PHENOMENA Ph.D. Thesis
John Harold Porter 1976 198 p
Avail: Univ. Microfilms Order No. 76-11820

In the study of atomic structure, an important class of observations comes from the scattering of low energy electrons by low density atomic beams. Techniques for performing such experiments are developed and these techniques are employed to study elastic scattering resonance phenomena in the rare gases. A great deal of effort has been put into the analysis of instrumental behavior, using both analytical and numerical techniques. The result has been the creation of a unique and well understood electron gun, the operating characteristics of which have been shown to correspond very closely to the theoretical predictions. A number of improvements to the associated electron monochromator and detection equipment were made. Dissert. Abstr.

N76-23957 Saskatchewan Univ., Saskatoon.
A COINCIDENCE STUDY OF THE REACTION He-3 (e, pd)e' Ph.D. Thesis
Conrado Pla 1975 129 p
Avail: Univ. Microfilms Order No. 76-10549

The two-body electrodisintegration process of He-3 has been studied by detecting outgoing protons and deuterons in coincidence. The energy transfer range studied is between 14 MeV and 29.5 MeV, and the momentum transfer dependence of the cross section at a fixed energy transfer of 21 MeV has also been investigated. The results have been compared with a theory in the impulse approximation and found that the agreement is poor. By the use of a model independent analysis, the monopole transition strength at omega = 21 MeV has been found to be approximately 10%. The triple differential cross section at q equals omega is consistent with some of the photodisintegration cross sections. Dissert. Abstr.

N76-23958 Ohio State Univ., Columbus.
STUDY OF THE LIQUID SURFACE OF SUPERFLUID HELIUM BY SCATTERING OF HELIUM ATOMS AND PROPAGATION OF SURFACE SOUND Ph.D. Thesis
Chun Pang Tam 1975 175 p
Avail: Univ. Microfilms Order No. 76-10056

The surface of superfluid He-4 with controlled amounts of He-3 impurity was studied from 34 mK to above 200 mK by measurements of the surface tension, the propagation of surface sound and the scattering of He-4 atoms. For nearly pure He-4 containing 0.4 + or - 0.2 ppb of He-3 corresponding to .0004 of a monolayer of He-3 on the surface, the elastic scattering probability or reflection coefficient, which is measured as a function of the momentum of the atom and the angle of incidence, is found to be independent of temperature up to 240 mK. The excitations produced by the incident atoms were studied using a bolometer immersed in the liquid. A physical model in which each absorbed atom produces a single phonon or roton partially accounts for the signal observed inside the liquid and its dependence on angle. Dissert. Abstr.

N76-23959 New York Univ., N.Y.
COULOMB IONIZATION OF INNER SHELLS BY HEAVY CHARGED PARTICLES Ph.D. Thesis
Grzegorz Lapicki 1975 337 p
Avail: Univ. Microfilms Order No. 76-10191

The theory of inner-shell Coulomb ionization by heavy charged particles, of atomic number small compared to the target atomic number, is developed through the extension of work by Brandt for K shells to L shells. In slow collisions relative to the characteristic times of the inner shell electrons, the quantum-mechanical predictions in the plane-wave Born approximation can exceed experimental cross sections by orders of magnitude. The effects of the perturbation of the atom by and the Coulomb deflection of the particle during collisions are included in the theory. The perturbed atomic states amount to a binding of the inner-shell electrons to the moving particle in slow collisions, and to a polarization of the inner shells by the particle passing at large impact parameters during nonadiabatic collisions. Dissert. Abstr.

N76-23960*# California Univ., Los Angeles. School of Engineering and Applied Science.
INTERACTIONS OF SATELLITE-SPEED HELIUM ATOMS WITH SATELLITE SURFACES. 2: ENERGY DISTRIBUTIONS OF REFLECTED HELIUM ATOMS
S. M. Liu and E. L. Knuth Apr. 1976 46 p refs
(Grant NGR-05-007-416)
(NASA-CR-147227; UCLA-ENG-7638) Avail: NTIS HC $4.00 CSCL 20H

Energy transfer in collisions of satellite-speed (7,000 m/sec) helium atoms with a cleaned 6061-T6 satellite-type aluminum surface was investigated using the molecular-beam technique. The amount of energy transferred was determined from the measured energy of the molecular-beam and the measured spatial and energy distributions of the reflected atoms. Spatial distributions of helium atoms scattered from a 6061-T6 aluminum surface were measured. The scattering pattern exhibits a prominent backscattering, probably due to the gross surface roughness and/or the relative lattice softness of the aluminum surface. Energy distributions of reflected helium atoms from the same surface were measured for six different incidence angles. For each incidence angle, distributions were measured at approximately sixty scattering positions. At a given scattering position, the energy spectra of the reflected helium atoms and the background gas were obtained using the retarding-field energy analyzer. Author

N76-23961*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TARGET FOR PRODUCTION OF RADIOXENONS
J. W. Blue, R. Leonard, S. Jha (Cincinnati Univ.), V. J. Sodd (Cincinnati Univ.), and J. S. Vincent (TRIUMF) 1976 8 p refs Presented at Am. Phys. Soc. Meeting, Washington, D. C., 26-29 Apr. 1976
(NASA-TM-X-73409; E-8740) Avail: NTIS HC $3.50 CSCL 20H

A liquid cesium target has been developed which allows the production and separate identification of the neutron deficient isotopes of xenon. The present report describes irradiations utilizing 34 to 41 MeV protons to produce millicurie quantities of Xe-127 and Xe-129m. At higher energies, however, the target could be used without modification to produce xenon isotopes as light as 119. Author

N76-23962*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TABLES OF THE COEFFICIENTS A
N. Chandra Nov. 1974 111 p refs
(NASA-TM-X-71103; X-602-74-294) Avail: NTIS HC $5.50 CSCL 20H

Numerical coefficients required to express the angular distribution for the rotationally elastic or inelastic scattering of electrons from a diatomic molecule were tabulated for the case of nitrogen and in the energy range from 0.20 eV to 10.0 eV. Five different rotational states are considered. Author

N76-23963# Argonne National Lab., Ill.
RADIATION DAMAGE CONSIDERATIONS
B. R. T. Frost Aug. 1975 23 p refs Presented at the Colloq. on Fundamental of Structural Alloy Design, Seattle, 15-19 Sep. 1975
(Contract W-31-109-eng-38)
(CONF-750962-1; Conf-750954-1) Avail: NTIS HC $4.25

Radiation environments produce unique effects on the composition, microstructure, and defect population of alloys, resulting in time-dependent and time-independent change in mechanical properties. To illustrate these problems, the materials needs of the core of a Liquid Metal Fast Breeder Reactor (LMFBR) and of the first wall of a fusion reactor are discussed. In the

case of the LMFBR core, the phenomenon of void swelling causes serious design problems, and a research is being made for a low-swelling alloy that has adequate mechanical properties. The fusion reactor poses different problems because the neutron energy is high (14 MeV) and is accompanied by a high flux of charged particles. The long-term choices for a wall material have been narrowed to vanadium and niobium alloys. In the search for low-swelling, it has become clear that minor elements play an important role in determining the nature of the radiation effects. ERA

N76-23964# Los Alamos Scientific Lab., N.Mex.
EFFECTS OF IONIZING RADIATION ON ELECTRICAL PROPERTIES OF REFRACTORY INSULATORS
V. A. J. VanLint and J. M. Bunch 1975 18 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Technol. for Fusion Reactors, Gatlinburg, Tenn.
(Contract W-7405-eng-36)
(LA-UR-75-1846; Conf-751026-24) Avail: NTIS HC $4.50

The Los Alamos Reference Theta Pinch Reactor (RTPR) requires on the first wall an electrical insulator which will withstand transient high voltage at high temperature 10 sec after severe neutron and ionizing irradiation. Few measurements of electrical parameters for heavily disordered refractory insulators have been reported; estimates are made as to whether breakdown strength or conductivity will be degraded by the irradiation. The approach treats separately short-term ionization effects (free and trapped electrons and holes) and long-term gross damage effects (transmutation products and various lattice defects). Worst-case calculations based on lower limits to recombination coefficients limit process (1) to sigma much less than 5 to the minus 14th power mho/cm. Data on ionization induced conductivity in insulators predict for process (2) sigma much less than 10 to the minus 8th power mho/cm. Electronic breakdown generally occurs at fields well above the 1,000,000 V/cm required for RTPR. Author (ERAD)

N76-23965# Brookhaven National Lab., Upton, N.Y.
ANALYSIS OF RADIATION DAMAGE IN FUSION-SIMULATION NEUTRON SPECTRA
D. M. Parkin and A. N. Goland 1975 20 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Tech. for Fusion Reactors, Gatlinburg, Tenn., 1 Oct. 1975
(BNL-20531; Conf-751026-21) Avail: NTIS HC $4.50

Various parameters which are relevant to an understanding of radiation effects in metals were evaluated utilizing available neutron spectrum information for several existing sources, e.g., EBR2, HFIR, and LAMPF, as well as the hypothetical spectrum at a fusion reactor first wall, and measured Li(d,n) spectra. Recoil energy distributions were calculated for several metals including Al, Cu, and Nb. The recoil energy range was divided into groups, and the fraction of recoils occurring in each energy group was compared with the fraction of the damage energy contributed by that group. It was possible to conclude that the significant recoil range differs by about an order of magnitude between fission and fusion sources. The analysis further confirms that basic defect production characteristics depend upon the neutron spectrum, and that integral calculations of radiation effect parameters do not provide a complete description of the dependence. NSA

N76-23966# New York Univ., N.Y. Dept. of Physics.
ATOMIC BEAM SCATTERING STUDIES Final Report, 1 Aug. 1972 - 31 Jul. 1975
Benjamin Bederson 1 Sep. 1975 8 p
(Grant DA-ARO(D)-31-124-73-G20)
(AD-A018377; ARO-10665.9-P) Avail: NTIS CSCL 07/4

This presents a summary of all measurements of electron-atom and electron-molecule cross sections performed under a grant. This includes measurements of total and differential, elastic and inelastic cross sections with and without spin analysis, particularly of alkali metal atoms and molecules. A similar summary of polarizability measurements is also presented. Other activities of the laboratory, and a summary of personnel associated with the grant, are also presented. GRA

N76-23967# Tennessee Univ., Knoxville.
REPORT ON TRAVEL TO THE INTERNATIONAL CONFERENCE ON ATOMIC COLLISIONS IN SOLIDS (5TH) AND ON ASSOCIATED VISITS TO ACCELERATOR LABORATORIES IN WEST GERMANY AND SWITZERLAND Trip Report, 20 Sep. - 6 Oct. 1975
I. A. Sellin 29 Oct. 1975 11 p Conf. held at Amsterdam, 22-26 Sep. 1975
(Contracts N00014-71-A-0121-0002; N00014-75-C-0474)
(AD-A018555; Rept-7502) Avail: NTIS CSCL 20/8

This presentation provides a means for studying the penetration of heavy charged particles in solids. GRA

N76-23968# Tennessee Univ., Knoxville.
APPLICATIONS OF BEAM FOIL SPECTROSCOPY TO ATOMIC COLLISIONS IN SOLIDS
I. A. Sellin 6 Jun. 1975 30 p refs
(Contract N00014-76-G-0004; NR Proj. 393-026)
(AD-A018556) Avail: NTIS CSCL 20/8

The present article will mainly summarize results presented at the Fourth International Conference on Beam-Foil Spectroscopy (held September 15-19, 1975 in Gatlinburg, Tennessee) which seem of particular pertinence to the community of scientists interested in ionic collision phenomena in solids. GRA

N76-23969# Naval Research Lab., Washington, D.C.
TRANSPORT TECHNIQUES FOR DESCRIBING THE ELASTIC SCATTERING OF ENERGETIC ELECTRONS Interim Report
D. J. Strickland (Science Applications, Inc., McLean, Va.) and I. B. Bernstein (Yale Univ.) Nov. 1975 47 p refs
(DNA Proj. NWET-L25AAXX633)
(AD-A018365; NRL-MR-3158) Avail: NTIS CSCL 20/8

An equation of transfer for elastic scattering, and the corresponding Fokker-Planck equation are solved for strongly forward-peaked scattering. The cross sections employed are appropriate to kilovolt electrons scattering off light nuclei. Results are shown for which the backscattered flux calculated with the transfer equation is sensitive to the cross section at large angles, indicating that single large-angle scattering can be important even though the cross section for it may contribute but a small fraction of the total cross section. Solutions of the Fokker-Planck equation agree well with those of the counterpart integral equation, provided sufficient scatters are present to make multiple small angle scattering dominant. For thin systems, the Fokker-Planck results for backscatter fall below the integral-equation results. The integral equation of transfer has been solved both numerically and in terms of its eigenfunctions and eigenvalues. Solutions by the two distinct methods agree to at least three significant places, thereby establishing the accuracy of the applied numerical techniques. GRA

N76-23970# Tennessee Univ., Knoxville.
THE INTERNATIONAL CONFERENCE ON BEAM-FOIL SPECTROSCOPY AND HEAVY ION ATOMIC PHYSICS SYMPOSIUM (4TH) Final Report, 1 Sep. - 10 Nov. 1975
I. A. Sellin 27 Oct. 1975 89 p refs Conf. held at Gatlinburg, Tenn., 15-19 Sep. 1975
(Contract N00014-76-G-0004)
(AD-A018772; Rept-7503) Avail: NTIS CSCL 20/7

This document is a final report concerning CNR support of the Fourth International Conference on Beam-Foil Spectroscopy and Heavy-Ion Atomic Physics Symposium. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-23971 British Library Lending Div., Boston Spa (England).
SEPARATION OF URANIUM ISOTOPES BY LASER
P. Rigny [1975] 19 p refs Transl. into ENGLISH from Comm. Energie at. (France), no. 204, Jun. 1975 p 61-69
(BLL-Risley-Tr-2896-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl: 2 BLL photocopy coupons

The use of the effects of laser irradiation for supplying enriched uranium at a low price is considered. The need for further research is emphasized. J.M.S.

N76-23972 Tennessee Univ., Knoxville.
A LINEAR TRIANGLE FINITE ELEMENT FORMULATION FOR MULTIGROUP NEUTRON TRANSPORT ANALYSIS WITH ANISOTROPIC SCATTERING Ph.D. Thesis
Richard Andrew Lillie 1975 155 p
Avail: Univ. Microfilms Order No. 76-11065

A finite element formulation, utilizing a canonical form of the transport equation, is developed to obtain both integral and pointwise solutions to neutron transport problems. To facilitate its application to nonorthogonal planar geometries, the formulation is based on the use of linear triangles. A general treatment of anisotropic scattering is included in the formulation by employing discrete ordinates like approximations. In addition, multigroup source outer iteration techniques are employed to perform group dependent calculations. The ability of the formulation to substantially reduce ray effects and its ability to perform streaming calculations are demonstrated by analyzing a series of test problems. Dissert. Abstr.

N76-23973*# Oregon Univ., Eugene.
ORBITAL ELECTRON CAPTURE BY THE NUCLEUS
W. Bambynek (EURATOM), H. Behrens (Zentralstelle fuer Atomkernenergie-Dokumentation, Karlsruhe, West Germany), M. H. Chen (Oregon Univ., Eugene), B. Crasemann (Oregon Univ., Eugene), M. L. Fitzpatrick (Glasgow Univ., Lanarkshire, Scotland), K. W D. Ledingham (Glasgow Univ., Lanarkshire, Scotland), H. Genz (Technische Hochschule, Darmstadt, West Germany), M. Mutterer (Technische Hochschule, Darmstadt, West Germany), and R. L. Intemann (Temple Univ., Philadelphia) [1976] 545 p refs Sponsored in part by AROD
(Grant NGR-38-003-036)
(NASA-CR-147953) Avail: NTIS HC $13.00 CSCL 20H

The theory of nuclear electron capture is reviewed in the light of current understanding of weak interactions. Experimental methods and results regarding capture probabilities, capture ratios, and EC/Beta(+) ratios are summarized. Radiative electron capture is discussed, including both theory and experiment. Atomic wave function overlap and electron exchange effects are covered, as are atomic transitions that accompany nuclear electron capture. Tables are provided to assist the reader in determining quantities of interest for specific cases. Author

N76-23974# California Univ., Livermore. Lawrence Livermore Lab.
PHYSICS OF RELATIVISTIC ELECTRON BEAMS IN RECTANGULAR AND CYLINDRICAL GEOMETRIES
L. G. Schlitt and L. P. Bradley Nov. 1975 22 p refs Presented at the 1st Intern. Topical Conf. on Electron Beam Res. and Technol., Albuquerque, 3-5 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77203; Conf-7501108-10) Avail: NTIS HC $4.50

The use of electron beams for the direct pumping of lasers for fusion applications requires the generation of large area beams in appropriate geometries. Two geometries which are of particular interest are rectangular electron beams with planar anodes and radially converging beams with cyclindrical anodes. The generation of such beams requires the management of electron trajectories in a complex combination of applied and self-generated electric and magnetic fields. The beam's self-electric field limits the emitted current, and the deflection of the electron in the selfmagnetic field (beam pinch) limits the beam area that can be generated from a single cathode. A simple analytic model is used to derive a scaling relationship for beam pinch in both geometries. Numerical calculations are presented to show the effects of nonuniform electric fields encountered in typical geometries together with supporting experimental measurements. Author (ERA)

N76-23975# Hanford Engineering Development Lab., Richland, Wash.
CONTROLLED THERMO-NUCLEAR RESEARCH Quarterly Report, Apr. - Jun. 1975
D. G. Doran and H. H. Yoshikawa Jul. 1975 41 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-75-90) Avail: NTIS HC $5.45

The effects of pulsing of a neutron source on the nucleation of defect microstructures are studied. It is shown that significant throttling of nucleation rates may occur in irradiation systems of interest. If the vacancy-cluster binding energy is sufficiently high, the previously found nucleation enhancement can give way to a diminution due to the decreased vacancy supersaturation. New displacement damage cross sections are given for Al, Ni, Cu, Zr, W, and Pb. Preliminary attempts to estimate displacement cross sections for energetic protons in nickel suggest Rutherford based values are low by perhaps 40 percent at 20 MeV and 60 percent at 30 MeV. A brief description is given of irradiations performed with the RTNS to measure helium production cross sections at 14 MeV. Author (NSA)

N76-23976# Sandia Labs., Albuquerque, N.Mex.
ION BEAM GENERATION AND FOCUSING
P. A. Miller, C. W. Mendel, D. W. Swain, and S. A. Goldstein 1975 22 p refs Presented at the 1st Intern. Topical Conf. on Electron Beam Res. and Tech., Albuquerque, N. Mex., 3 Nov. 1975 Sponsored by ERDA
(SAND-75-5751; Conf-751108-5) Avail: NTIS HC $4.50

Calculations have shown that efficiently generated and focused ion beams could have significant advantages over electron beams in achieving ignition of inertially confined thermonuclear fuel. Efficient ion beam generation implies use of a good ion source and suppression of net electron current. Net electron flow can be reduced by allowing electrons to reflex through a highly transparent anode or by use of transverse magnetic fields (either beam self-fields or externally applied fields). Geometric focusing can be achieved if the beam is generated by appropriately shaped electrodes. Experimental results are presented which demonstrate ion beam generation in both reflexing and pinched flow diodes. Spherically shaped electrodes are used to concentrate a proton beam, and target response to proton deposition is studied. Author (NSA)

N76-23977# Battelle Pacific Northwest Labs., Richland, Wash.
ION BOMBARDMENT SIMULATION: A REVIEW RELATED TO FUSION RADIATION DAMAGE
J. L. Brimhall 1975 22 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Technol. for Fusion Reactors, Gatlinburg, Tenn.
(Contract E(45-1)-1830)
(BNWL-SA-5400; Conf-751026-29) Avail: NTIS HC $4.50

Prime emphasis is given to reviewing the ion bombardment data on the refractory metals molybdenum, niobium, and vanadium which are proposed for use in advanced fusion devices. The temperature and dose dependence of the void parameters are correlated among these metals. The effect of helium and hydrogen gas on the void parameters is also included. The similarities and differences of the response of these materials to high dose, high temperature radiation damage are evaluated. Comparisons are made with results obtained from stainless steel and nickel base alloys. The ion bombardment data are then compared and correlated with existing neutron data on the refractory metals. The theoretically calculated damage state produced by neutrons and ions is also briefly discussed and compared to experimental data. The advantages and limitations of ion simulation in relation to fusion radiation damage are finally summarized. Author (ERA)

N76-23978# Illinois Univ., Urbana. Dept. of Chemistry.
A STUDY OF MOLECULAR PAIR POTENTIALS, A SEMI-EMPIRICAL APPROACH
R. L. Ellis Dec. 1975 31 p refs Submitted for publication
(Contract N00014-75-C-0942; NR Proj. 359-585)
(AD-A018459; TR-2) Avail: NTIS CSCL 20/10

An expression is developed for the short range molecular pair potentials within the framework of the Heitler-London approach for molecules in a closed shell state. Assumptions common with the CNDO/2 semi-empirical method are employed in evaluating the molecular integrals. The final expression depends only on quantities related to the atoms making up each molecule. Although several approximations are introduced to obtain this expression, these are related to the evaluation of integrals, and no adjustable parameters are required for the evaluation of the potential. This potential is in good agreement with the results of ab initio calculations for the system He/H2, Ne/H2 and HF/HF.

A comparison is also made with the results of the Gordon-Kim method for the system HF/HF. The method presented in this work is found to be computationally approx. 3,000 times faster per data point than the Gordon-Kim method with comparable results. GRA

N76-23979# Harry Diamond Labs., Adelphi, Md.
NEPTUNE-C ELECTRON BEAMS
Dale R. Schallhorn, Gary L. Skillington, and Robert B. Oswald, Jr. Sep. 1975 24 p
(DNA Proj. NWED-QAXAA121)
(AD-A018696; HDL-TR-1723) Avail: NTIS CSCL 20/7

The purpose of the studies reported here was to characterize the electron beams emitted by Neptune-C. The characteristics of particular interest were the reproducibility and uniformity of the beams, the fluence transmitted through carbon as a function of distance in the carbon, and the number of pulses that an experimenter can expect to use during an 8-hr run. GRA

74 OPTICS

Includes light phenomena.

N76-23980 Ohio State Univ., Columbus.
REFRACTION DIAGNOSTICS FOR AXISYMMETRIC MEDIA Ph.D. Thesis
Allen Martin Hunter, II 1975 133 p
Avail: Univ. Microfilms Order No. 76-9983

The purpose is to develop analytical and numerical methods which are appropriate for using measured data to determine refractive index distributions in strongly refracting axisymmetric media with negligible axial gradients. All of the diagnostic techniques are based on geometrical optics refraction, and ray paths are obtained by applying Fermat's principle. Three techniques are developed for the detailed numerical analysis of experimental data. One uses the distribution of the total angle of refraction to infer the refractive index distribution; the other two use interference fringe shifts from two-beam, single-pass interferometers such as the Mach-Zehnder. The refraction angle diagnostic technique is presented in two analytic forms. One of the interferometric diagnostic techniques often can be used to accurately reduce data directly. The other method, based on the iterative separation of medium and optical system contributions to the data, is more general. Dissert. Abstr.

N76-23981*# Kanner (Leo) Associates, Redwood City, Calif.
AN INSTRUMENT FOR PHOTOELECTRIC MEASUREMENT OF IMAGE SHARPNESS
D. Zindel Washington NASA May 1976 7 p refs Transl. into ENGLISH from Zeitschrift fuer Astrophysik (Germany), v. 57, no. 2, 1963 p 83-86
(Contract NASw-2790)
(NASA-TT-F-17037) Avail: NTIS HC $3.50. CSCL 20F

An instrument for photoelectric measurement of the sharpness of the solar image is described. The results are compared with visual estimates. Author

N76-23982*# Pan American Univ., Edinburg, Tex.
FURTHER LABORATORY STUDY OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS OCCURRING ON ASTRONOMICAL OBJECTS Final Report
Frederic M. Glaser May 1976 66 p
(Grant NGR-44-087-002)
(NASA-CR-147935) Avail: NTIS HC $4.50 CSCL 20F

Oligoclase and bloedite, two mined samples, have been investigated, and the diffuse reflectance spectra are presented. These data are for powdered material, 50 microns to 5 microns size mixture, cooled to 160 K. The reflectivity of the oligoclase sample was also measured at room temperature, about 290 K, and the results at these two temperatures do indicate some tentative differences. A frost of ordinary water was prepared and its spectral reflectance is presented. This result compares reasonably well with measurements made by other investigators. Author

N76-23983* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CUBIC INTERLEAVER Patent Application
James R. Fischer, inventor (to NASA) Filed 21 Apr. 1976 28 p
(NASA-Case-GSC-12111-1; US-Patent-Appl-SN-678813) Avail: NTIS HC $3.50 CSCL 20F

A fiber optic image processing device of cubic form is described. This device consists of alternate layers of square fiber optic filaments wherein the fibers comprising alternate layers are arranged perpendicular with respect to one another. This arrangement permits image combining and duplication in itself, and also serves as the building block for a number of more sophisticated image processing devices which can be combined to form logic networks for processing and storing images. NASA

N76-23984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GREGORIAN ALL-REFLECTIVE OPTICAL SYSTEM Patent Application
William B. King, inventor (to NASA) (Hughes Aircraft Co., Los Angeles) Filed 28 Apr. 1976 16 p Sponsored by NASA
(NASA-Case-GSC-12058-1; US-Patent-Appl-SN-680938) Avail: NTIS HC $3.50 CSCL 20F

An optical heterodyne receiver comprises a system of reflectors forming a folded Gregorian configuration for collecting a signal beam, and an optical detector located at the focus of the system. The reflectors comprise a paraboloidal primary reflector and an ellipsoidal secondary reflector facing each other on an optical axis with the focus of the secondary reflector coinciding with the focus of the primary reflector. An auxiliary laser generates a local oscillator beam that is combined with the signal beam after the signal beam emerges from the exit pupil (which is also the aperture stop) of the system, and the resultant is impinged on the detector. A pair of image motion compensators is located as close to the exit pupil as possible for aligning off-axis inputs to the detector. NASA

N76-23985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTICAL SCANNER Patent Application
David B. Rhodes, inventor (to NASA) Filed 6 Apr. 1976 8 p
(NASA-Case-LAR-11711-1; US-Patent-Appl-SN-674195) Avail: NTIS HC $3.50 CSCL 20F

A patent application for the invention of an optical scanner that sequentially focuses optical energy (light) at selected points in space was presented. The essential component of the invention is a scanning wheel including several glass windows with each window having a different thickness. Due to this difference in thickness, the displacement of the emerging light from the incident light is different for each window. The scanner transmits optical energy to a point in space while at the same time receiving any optical energy generated at that point and then moves on to the next selected point and repeats this transmit and receive operation. It fills the need for a system that permits a laser velocimeter to rapidly scan across a constantly changing flow field in an aerodynamic test facility. Author

N76-23986# Sandia Labs., Livermore, Calif.
OPTICAL TECHNIQUE FOR STRAIN MEASUREMENT OF MATERIAL SPECIMENS AT ELEVATED TEMPERATURES
R. A. Thompson, W. E. Jorgenson, and M. L. Callabresi Sep. 1975 23 p refs
(Contract AT(29-1)-789)
(SAND-75-8261) Avail: NTIS HC $4.50

An optical technique was developed for the measurement of strain in material specimens using a laser light source and an optical extensometer. This technique was used up to temperatures of 2,200 C with the aid of special optical targets attached to the specimen. Operational procedures and experimental data from room and elevated temperature tests are presented. Author (ERA)

N76-23987# Naval Research Lab., Washington, D.C.
ANALYSIS OF A PROPOSED BEAM LINE FOR THE AFRRI LINAC Final Report
Warren L. Bendel Oct. 1975 30 p
(NRL Proj. H01-63)

(AD-A018230; NRL-MR-3140) Avail: NTIS CSCL 20/6

A proposed beam line for the Linac facility at the Armed Forced Radiobiology Research Institute was studied. The proposed beam line is based on available components. Beam transport optics were done with a computer program named TRANSPORT. Some additional data were calculated from the computer output. With certain assumed Linac beam parameters, about a 6% band of electron momentum can be transported with a spot about 0.5 inch in diameter at the target. Author (GRA)

N76-23988# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LIGHT SCATTER IN THE EARTH'S ATMOSPHERE

V. G. Fesenkov 13 Nov. 1975 140 p refs Transl. into ENGLISH from Rasseyaniye Sveta Zemnoy Atmosfere (Alma-ata), 1972

(AD-A018536; FTD-ID(RS)T-2180-75) Avail: NTIS CSCL 20/6

Contents: Aerosols in atmosphere and in space; diagrams of polydisperse aerosol and inverse problems of diffusion of light; scattering of light in lowest layer of the atmosphere and atmospheric aerosol; the special peculiarity of aerosol component of the thickness of the atmosphere above the desert; effect of microstructure and distribution of aerosol particles according to dimensions on the optical characteristics of aerosol; some results of the investigation of the spectral weakening of IR radiation by the surface atmosphere; aerosol indicatrix of scattering in a near infrared region of the spectrum; some optical characteristics of daytime sky and spectrum of aerosol; investigation of atmospheric aerosol by optical methods; and statistical structure of aerosol transparency with constant mass. GRA

N76-23989# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THEORETICAL INVESTIGATIONS OF A TUNABLE COLLINEAR ACOUSTO-OPTIC FILTER M.S. Thesis

C. David DePriest Mar. 1975 140 p refs

(AD-A018333; GEO/PH/75-1) Avail: NTIS CSCL 20/6

An acousto-optic filter employing collinear interaction of light and sound is analyzed. Relations between the photoelastic tensor, impermeability tensor, and optic and acoustic waves are explored. A method of determining the compatibility of acoustic and optic polarizations and crystal orientation is developed and the results are tabulated. The equations relating birefringence, and acoustic and optic frequencies, as well as those relating acoustic power, crystal length, and wave length, are derived and discussed. The bandwidth relations are discussed and bandwidth over the visual and near IR spectra is predicted for two specific filters. Use of the filter in front of a vidicon to obtain spectral characteristics of visible scenes is investigated. Use in conjunction with a laser and photomultiplier to illuminate and detect distant objects is considered, and computer solutions of maximum object distance are given in graphical form. GRA

N76-23990# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Engineering.

STRESS OPTICAL PROPERTIES OF SOLIDS IN THE 1 TO 20 MICRON WAVELENGTH REGION Final Report, 1 Aug. 1973 - 30 Jun. 1975

John P. Szczesniak and John C. Corelli Jul. 1975 33 p refs (Contract F19628-74-C-0032; AF Proj. 3326)

(AD-A018871; AFCRI-TR-75-0476) Avail: NTIS CSCL 20/6

The application of a variation of intensity method using static uniaxial compressive stress and polarized light to measure stress-induced birefringence in the infrared wavelength region (approximately 1 to 12 microns) is described. The measurements were made at 296 K for the following materials: KCl, KBr, KI, NaCl, LiF, ZnS, ZnSe and SrF2, CaF2, MgF2 and a chalcogenide glass TI-1173 for the alkali halides the values of the stress optic coefficients obtained are in the range approximately 1 to 4 Brewsters, while for the non-oxide glasses values of 9 to 14 Brewsters were measured. Comparisons of measurements from experiments with a theoretical model which predicts the wavelength dispersion of stress birefringence cannot be fitted better than a factor of approximately 2. Author (GRA)

N76-23991# RCA Labs., Princeton, N.J.

HIGH-SPEED LIGHT-EMITTING DIODES, VOLUME 1 Final Report, 1 Apr. 1973 - 30 May 1975

Michael Ettenberg, James P. Wittke, and Henry Kressel Jun. 1975 65 p refs

(Contract N00014-73-C-0335)

(AD-A018757; PRRL-75-CR-37-Vol-1) Avail: NTIS CSCL 20/6

This report describes the experimental and theoretical results of a program for the development of light-emitting diodes specifically designed for fiber-optic communications. Among the important achievements are the development of a diode capable of efficient operation at modulation frequencies in excess of 200 MHz, and the realization of a novel edge-emitting structure (the REED) which combines the efficiency of the surface-emitting diode with the narrow emission beam width of the edge emitter desirable for coupling into low numerical aperture (NA) fibers. One of the most important results discovered is the strong effect that adding Al to the GaAs in the recombination region has on improving the resistance to gradual degradation. By combining this characteristic with the use of edge-passivated stripe-contact structures, diodes have been demonstrated that operate at 1,000 A/sq cm and exhibit no degradation after many thousands of hours. GRA

N76-23992# Pennsylvania State Univ., University Park. Materials Research Lab.

PIEZO-OPTIC PROPERTIES OF LIQUIDS UNDER HIGH PRESSURE Technical Report, 1 May - 22 Dec. 1975

K. Vedam 22 Dec. 1975 10 p refs

(Contract N00014-75-C-0915; NR Proj. 381-018)

(AD-A018704; MRL-KV-75-1; TR-1) Avail: NTIS CSCL 20/6

A new interferometric method of measuring delta n, the variation of refractive index of liquids with pressure, to 14 kbar is described. The results obtained on delta n versus pressure up to the freezing point of water and carbon tetrachloride at room temperature are presented and discussed. A schematic diagram of the experimental arrangement is shown. With such a system it is now possible to carry out precision interferometric measurements on the piezo- and elasto-optic properties of various liquids, up to a maximum pressure of 14 kbars. GRA

N76-23993# Harris Corp., Melbourne, Fla. Electronic Systems Div.

FIBER OPTICS COMMUNICATIONS LINK STUDY Final Report, 2 Jan. - 30 Jul. 1975

I. B. Slayton, J. J. Pan, P. W. Casper, and G. L. Buchanan Griffiss AFB, N. Y. RADC Nov. 1975 70 p refs

(Contract F30602-75-C-0087)

(AD-A018898) Avail: NTIS CSCL 20/6

This final report documents the results of a six month program of study which was conducted to establish and evaluate the merits of using fiber optic cables for transmitting sensor data from balloon deployed observation platforms to ground based monitoring stations. The baseline system application analyzed, for the purposes of this study, was the RADAR command and data links associated with the SEEK SKYHOOK program. To establish the advantages of applying fiber optics technology to such an application, a complete optical cable system was designed and compared with the presently deployed microwave communications link, based on cost and performance. Specific elements designed as part of the study included an integrated fiber cable and balloon tether, optical transmitter and receiver, and the electro-optical hardware for interfacing with the existing ground and balloon based equipment. GRA

N76-23994# Ballistic Research Labs., Aberdeen Proving Ground, Md.

TESTS OF AN ELLIPSOIDAL MIRROR REFLECTOMETER

John D. Sullivan, Jr. and Frank J. Allen Oct. 1975 54 p refs

(AD-A018781; BRL-MR-2551) Avail: NTIS CSCL 20/6

Apparatus was assembled to form a reflectometer based on an ellipsoidal mirror. The target is mounted with provision for flame heating and temperature sensing. Reflectance measurements in the near infrared were compared with those taken with a commercial instrument, a Beckman DK-2A. The result is a 16% disagreement which is attributed to sensitivity to the reflectance pattern from a unidirectionally scratched target. The reflectance data scatter is + or - 0.04 with the ellipsoidal mirror; the scatter is seven times less with the Beckman. An improved

averaging sphere coating will be necessary for making reflectance measurements in the middle infrared. Author (GRA)

N76-23995# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
VISIBLE LIGHT SENSOR Final Report, Oct. 1974 - Aug. 1975
R. Fowski, H. Levenstein, R. Stoll, R. Grosso, and J. Moorhead Nov. 1975 210 p refs
(Contract F04701-74-C-0506)
(AD-A018703; SAMSO-TR-75-264) Avail: NTIS CSCL 17/8

The work was primarily concerned with examination of optical systems for employment in the detection of faintly visible objects. The general problems of image quality, field of view, focal surface definition, throughput, optical form, out-of-field source rejection, and sensitivity to thermal and radiation effects of the environment are specific with solutions directed to minimize size and weight. The parameters that are summarized are for three candidate step and stare systems, that is to say, a system that searches the sky by serially examining contiguous areas of angular space, dwelling (staring) long enough at each site to effect detection and then moving into the next segment. A good design allows close approach to earth limb to assure overlap with current space track detection capability, and allows close approach to the sun to minimize blind regions of operational outage. GRA

N76-23996# General Electric Co., Utica, N.Y. Aerospace Electronic Systems Dept.
SOLID STATE MINI-RPV COLOR IMAGING SYSTEM
L. J. Langan 12 Sep. 1975 166 p refs
(Contract F33615-74-C-2048; ARPA Order 2713)
(AD-A018909) Avail: NTIS CSCL 17/8

The general purpose of the project was to use solid state sensors in the development of a false color camera compatible to packaging and interface constraints of the Aequare RPV. The first task was to develop a Charge Injection Device in a 244 x 248 (vertical x horizontal) array configuration. This device, in turn, was used as the sensor for a three sensor false color camera which was designed and constructed compatible to the Aequare configuration. Finally, since a significant aspect of the Charge Injection Device is its potential for random access, a study was done to predict performance parameters for the case of a randomly accessible device. All tasks have been completed with deliverable hardware being represented by the Color Camera and a Color Monitor. The random access study emphasized operational timing constraints and was conducted by considering an actual layout for a 128 x 128 array with projections to a 256 x 256 array. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-23997 Northwestern Univ., Evanston, Ill.
NUMERICAL SIMULATION METHODS FOR COLLISIONAL AND TURBULENT HEATING OF PLASMAS Ph.D. Thesis
Carl Erich Rathmann 1975 114 p
Avail: Univ. Microfilms Order No. 76-11979

The development and testing of two algorithms for the numerical simulation of collisional and turbulent heating of electrons in plasmas is described. In the first algorithm the electric field is computed from Poisson's equation at time intervals which are small compared to the electron plasma period. The original features of this algorithm are the use of a non uniform velocity grid and the inclusion of a one-dimensional Fokker-Planck collision term. In the second algorithm particles are advanced on a long time scale by computing their linearized trajectories over time intervals which are small compared to the electron trapping periods. The electric field is updated in terms of a fluid formulation of plasma dynamics including time-dependent excitation coefficients which are computed in terms of the energy transfer between the electric field and resonant particles. Several examples of application of this algorithm are also given. Dissert. Abstr.

N76-23998*# Stanford Univ., Calif. Inst. for Plasma Research.
SIMPLIFIED THEORY OF LARGE-AMPLITUDE WAVE PROPAGATION
Hongjin Kim Mar. 1976 36 p refs
(Grants NGL-05-020-176; NSF MPS-74-14284-A01)
(NASA-CR-147229; SU-IPR-582) Avail: NTIS HC $4.00 CSCL 20I

An orbit perturbation procedure was applied to the description of monochromatic, large-amplitude, electrostatic plasma wave propagation. In the lowest order approximation, untrapped electrons were assumed to follow constant-velocity orbits and trapped electrons were assumed to execute simple harmonic motion. The deviations of these orbits from the actual orbits were regarded as perturbations. The nonlinear damping rate and frequency shift were then obtained in terms of simple functions. The results are in good agreement with previous less approximate analyses. Author

N76-23999*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATIVE APPROACHES TO FUSION
Reece J. Roth 1976 54 p refs Presented at course on controlled fusion, Austin, Tex., 26-28 May 1976; sponsored by IEEE Nucl. and Plasma Sci. Soc.
(NASA-TM-X-73429) Avail: NTIS HC $4.50 CSCL 20I

The limitations of the Tokamak fusion reactor concept are discussed and various other fusion reactor concepts are considered that employ the containment of thermonuclear plasmas by magnetic fields (i.e., stellarators). Progress made in the containment of plasmas in toroidal devices is reported. Reactor design concepts are illustrated. The possibility of using fusion reactors as a power source in interplanetary space travel and electric power plants is briefly examined. J.R.T.

N76-24000*# Maryland Univ., College Park.
SHIFT MEASUREMENTS OF THE STARK-BROADENED IONIZED HELIUM LINES AT 1640 AND 1215 ANGSTROM Ph.D. Thesis
James R. VanZandt 1976 139 p refs Sponsored by NASA and NSF
(NASA-CR-146227; TR-76-077; PUBL-76-134) Avail: NTIS HC $6.00 CSCL 20I

Time-resolved measurements were made of the shifts of the ionized helium lines at 1,640 A (n = 3 approaches 2) and 1,215 A (n = 4 approaches 2), and of the Stark profile of the 1,215 A wavelength line. An electromagnetic shock tube was used as a light source. The plasma conditions corresponded to electron temperatures of approximately 3.5 eV and electron densities of 0.8 to 1.8 x 10 to the 17th power/cubic cm. The measured shifts fell between two previous estimates of plasma polarization shifts. The measured Stark width of the 1,215 A wavelength line was up to 30% greater than the theoretical width. Author

N76-24001*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLASMA CLEANING DEVICE Patent Application
Roger L. Shannon (Boeing Co., Seattle) and Robert B. Gillette, inventors (to NASA) (Boeing Co., Seattle) Filed 10 May 1976 12 p
(Contract NAS8-26385)
(NASA-Case-MFS-22906-1; US-Patent-Appl-SN-684807) Avail: NTIS HC $3.50 CSCL 20I

An apparatus for cleaning contaminated surfaces such as hydrocarbon contaminant films in high vacuum environments is described. A plasma discharge housing for allowing a plasma to be generated in an environment having a higher pressure than the surface which is to be cleaned is used. A ground electrode and a radio frequency electrode partially surround a quartz plasma tube, for the introduction of an ionizable gas. These electrodes ionize the gas and help generate the plasma. This plasma flows through a nonconstrictive aperture, through the plasma discharge housing and on to the contaminated surface. NASA

N76-24002# California Univ., Livermore. Lawrence Livermore Lab.
MODE COUPLING OF ELECTRON PLASMA WAVES

Ph.D. Thesis
J. A. Harte 31 Oct. 1975 121 p refs
(Contract W-7405-eng-48)
(UCRL-51946) Avail: NTIS HC $5.45

The driven coupled mode equations are derived for a two fluid, unequal temperature (T/sub e/ much greater than T/sub i/) plasma in the one-dimensional, electrostatic model and applied to the coupling of electron plasma waves. Terms up to quadratic in pump power are retained. The equations describe the linear plasma modes oscillating at the wave number k and at omega/sub ek/, the Bohn Gross frequency, and at OMEGA/sub k/, the ion acoustic frequency, subject to the damping rates nu/sub ek/ and nu/sub ik/ for electrons and ions and their interactions due to intense high frequency waves E/sub k/ sup 1/. Author (ERA)

N76-24003# Oak Ridge National Lab., Tenn.
OAK RIDGE TOKAMAK EXPERIMENTAL POWER REACTOR STUDY REFERENCE DESIGN
M. Roberts Nov. 1975 133 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5042) Avail: NTIS HC $7.60

A Tokamak EPR Reference Design is presented as a basis for further design study leading to a Conceptual Design. The set of basic plasma parameters selected--minor radius of 2.25 m, major radius of 6.76 m, magnetic field on axis of 4.8 T and plasma current of 7.2 MA--should produce a reactor-grade plasma with a significant neutron flux. Neutronics and heat transfer calculations coupled with mechanical design and materials considerations were used to develop a blanket and shield capable of operating at high temperature, and protecting the surrounding coils, while being maintained remotely. In a few experimental modules; breeding tritium superconductors are used in the toroidal field coil design. The coil system was developed for a maximum field of 11 T at the winding (to give a field on axis of 4.8 T), and combines multifilamentary superconducting cable with forced flow of supercritical helium enclosed in a steel conduit.
Author (ERA)

N76-24004# Illinois State Water Survey, Urbana.
MONTE CARLO SIMULATION OF NEUTRAL BEAM INJECTION INTO FUSION REACTORS
R. L. Miller 15 Sep. 1975 31 p refs
(Contract AT(11-1)-2218)
(COO-2218-38) Avail: NTIS HC $5.00

Motivations and techniques for the Monte Carlo computer simulation of energetic neutral beam injection for fusion reactors are described. The versatility of this approach allows a significantly more sophisticated treatment of charge transfer collision phenomena and consequent effects on engineering design than available from prior work. Exemplary results for a mirror fusion engineering research facility are discussed. Author (ERA)

N76-24005# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE INTERACTION OF HIGH-FREQUENCY OSCILLATIONS IN THE DECIMETER RANGE WITH PLASMA IN THE TOKAMAK TM-3 UNIT
V. V. Alikaev, Yu. I. Arsenev, G. A. Bobrovskii, V. I. Poznyak, K. A. Razumova, and Yu. A. Sokolov 1975 8 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 45, no. 3, 1975 p 523-526
(ERDA-tr-69) Avail: NTIS HC $4.00

The phenomena arising during the interaction of high frequency radiation with plasma, primarily under the conditions omega/sub He/greater than omega greater than or equal to root omega/sub He/omega/sub Hi/and omega/sub pe/greater than omega greater than or equal to omega/sub pi/ was studied. Considerable absorption of the high frequency power was observed throughout the entire range of parameters characterizing the Tokamak plasma. This absorption was accompained by ion heating, additional displacement of the plasma column, and the appearance of hard X-ray radiation. Author (ERA)

N76-24006# Oak Ridge National Lab., Tenn.
DYNAMIC OVERALL ENERGY BALANCE OF CLEAN AND IMPURITY-CONTAMINATED TOKAMAK REACTORS
T. Hiraoka, J. R. McNally, Jr., and D. Steiner Nov. 1975 124 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4843) Avail: NTIS HC $5.45

The energy balance for impurity-contaminated reactors is investigated dynamically because impurities shorten the burning time considerably. The energy balance of the whole reactor system, including engineering aspects that support plasma burning over a complete cycle is evaluated. The reactor system is analyzed with regard to plasma physics and reactor-engineering parameters, and realistic engineering limitations are imposed. A zero-dimensional model is assumed, and the dynamic overall energy balance is investigated over a complete cycle (from the initial heating stage until the beginning of the next discharge). Simultaneous time-dependent differential equations are solved for particle density and ion and electron temperatures based on trapped particle mode losses. Author (ERA)

N76-24007# Los Alamos Scientific Lab., N.Mex.
PLASMA HEATING BY RELATIVISTIC ELECTRON BEAMS, CORRELATIONS BETWEEN EXPERIMENT AND THEORY
L. E. Thode and B. B. Godfrey 1975 35 p refs Presented at the 1st Intern. Topical Conf. on Electron Beam Res. and Tech., Albuquerque, N. Mex., 3 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2030; Conf-751108-6) Avail: NTIS HC $4.50

In plasma heating experiments, the relativistic beam must traverse an anode foil bfore interacting with the plasma. The linear theory for a scattered beam is discussed, including a criterion for the onset of the kinetic interaction. A nonlinear model of the two-stream instability for a scattered beam is developed. Using this model, data from ten experiments are unfolded to obtain the correlations for a fixed anode foil. The dependence of the plasma heating on the beam to plasma density ratio is due to anode foil scattering. For a fixed beam to plasma density ratio, the predicted change in the magnitude of plasma heating as a function of the anode foil is in agreement with the experiment. The plasma heating tentatively appears to be proportional to the beam kinetic energy density and beam pulse length.
Author (ERA)

N76-24008# California Univ., Livermore. Lawrence Livermore Lab.
SELF-CONSISTENT MICROWAVE PLASMA HEATING RATES
D. L. Ensley and R. H. White Oct. 1975 31 p refs Presented at the 1st Intern. Topical Conf. on Electron Beam Res. and Tech., Albuquerque, N. Mex. 3 Nov. 1975 Sponsored by ERDA
(UCRL-77152; Conf-751108-11) Avail: NTIS HC $4.50

Comparisons between the three major plasma heating mechanisms: inverse bremsstrahlung (ordinary collisional heating), field pressure heating, and field reversal electron heating are made. Selfconsistent field calculations are reviewed. A relationship between the potential due to charge separation and the radiation field was obtained. This relation can be used to obtain a first approximation to the self-consistent fields. The computer code, ORBIT, which has been used to calculate field reversal heating rates is discussed. Classical collisional heating is estimated and the heating time is shown to be greater than the hydrodynamic disassembly time. Radiation pressure heating is estimated and the heating time is shown to be greater than the hydrodynamic disassembly time. The ORBIT computer code calculations which led to the discovery of field reversal heating indicate that field reversal heating is probably the most important heating mechanism in the microwave-plasma interaction.
Author (ERA)

N76-24009# Princeton Univ., N.J. Plasma Physics Lab.
TOROIDAL FIELD COILS FOR THE PRINCETON DIVERTOR EXPERIMENT
J. C. Citrolo and C. W. Bushnell Oct. 1975 20 p ref Presented at the 5th Intern. Conf. on Magnet Tech., Frascati, Italy, 21 Apr. 1975
(Contract E(11-1)-3073)
(MATT-1159; Conf-750438-10) Avail: NTIS HC $4.00

The toroidal field coils for the Princeton Divertor Experiment (PDX) and their supporting structure are described. The special demountable nature of the coils and the problems which result

from this feature are discussed. The procedures for assembly and fabrication of the coils are presented. Author (ERA)

N76-24010# Princeton Univ., N.J. Plasma Physics Lab.
ON CURRENT PENETRATION AND PLASMA DISRUPTION
T. H. Stix Nov. 1975 14 p refs
(Contract E(11-1)-3073)
(MATT-1187) Avail: NTIS HC $4.00

It is suggested that, in a Tokamak discharge, the initial rapid current penetration and the disruptive instability may each be attributed to a type of nonlinear double tearing instability which causes growth and overlap of radially separated magnetic islands. The ensuing reconnection and braiding of magnetic lines would enhance local radial heat and particle transport and could permit rapid redistribution of plasma current, inducing positive or negative spikes in the loop-voltage signal. Author (ERA)

N76-24011# Princeton Univ., N.J. School of Engineering and Applied Science.
PRINCETON FUSION POWER PLANT SUPERCONDUCTING MAGNET SYSTEM AND COSTS
J. File Oct. 1975 27 p refs Presented at the 5th Intern. Conf. of Magnet Tech., Frascati, Italy, 21 Apr. 1975
(Contract E(11-1)-3073)
(MATT-1158; Conf-750438-9) Avail: NTIS HC $4.00

Details are given of the superconducting magnet system consisting of toroidal field, divertor, ohmic heating, equilibrium field and control field magnets, all of which are wound of NbSn conductor. The toroidal field coils are of the moment-free, D type. The toroidal field magnet is comprised of 48 discrete D coils, 12m x 19m bore. The magnet which is operated at a maximum field of 16T is described in detail. Fault conditions are calculated, and design conditions based on maximum fault forces are outlined. In addition, the Dewar System, the refrigeration plant (requiring 280 kW of refrigeration), the safety system, and the coil protection system for the magnets are described. Finally, an overview of the helium-steam generating plant and detailed cost data for the plant, the nuclear island, and the magnet are presented. Author (ERA)

N76-24012# Sandia Labs., Albuquerque, N.Mex.
ANODE PLASMA AND FOCUSING REB DIODES
S. A. Goldstein 1975 27 p refs Presented at the 1st Intern. Topical Conf. on Electron Beam Res. and Tech., Albuquerque, N. Mex., 3 Nov. 1975 Sponsored by ERDA
(SAND-75-5765; Conf-751108-9) Avail: NTIS HC $5.00

The use of electrical, optical, X-ray, and particle diagnostics to characterize the production of anode plasma and to monitor its influence on beam generation and focusing is reviewed. Studies using the Nereus accelerator show that after cathode turn-on, deposition of several kJ/gm on the anode is necessary before ions from hydrocarbons, adsorbed gases, and heavier metallic species are detected. The actual time at which ions are liberated depends on several factors, one of which is the specific heat of the anode substrate. Once formed, anode ions cross the A-K gap (with an energy equal to the diode voltage) and interact with the cathode to produce an axially peaked beam profile, a pinch which does not follow the critical current criterion. Experiments with externally generated anode plasma show that this type of pinch can be attracted to localized areas on the anode. Preliminary observations on Hydra indicate the anode plasma composition is similar to that on Nereus. Author (ERA)

N76-24013# California Univ., Livermore. Lawrence Livermore Lab.
COMPACT HIGH-ENERGY NEUTRAL BEAM SYSTEM
O. A. Anderson 15 Aug. 1975 11 p refs
(Contract W-7405-eng-48)
(UCID-16914) Avail: NTIS HC $4.50

Pumping requirements for handling excess gas in a CTR high-energy neutral beam system are substantially reduced by using a cesium jet to act simultaneously as the charge-changing mechanism and as a reflector for excess deuterium gas. Practical applications and problems such as cesium contamination of the D+ source are discussed. Author (ERA)

N76-24014# Sydney Univ. (Australia). School of Physics.
[PLASMA PHYSICS RESEARCH, INCLUDING STUDIES ON PLASMA SOURCES AND LASER DIAGNOSTICS] Progress Report, 1 Jan. - 30 Jun. 1975
1975 21 p refs
(PR-29) Avail: ERDA Depository Libraries HC $4.25

Brief descriptions are given of research progress on the following topics: (1) plasma sources, (2) hydromagnetic shock waves, (3) rotating plasmas, (4) magnetohydrodynamics, (5) laser diagnostics, and (6) far-infrared radiation. Author (ERA)

N76-24015# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la fusion Controlee.
EQUILIBRIUM AND PERTURBATIONS IN PLASMA--VACUUM SYSTEMS
C. Mercier 1974 8 p refs Presented at the Tech. Conf. on Optimisation Tech., Novosibirsk, USSR
(CEA-CONF-3112; Conf-740760-1) Avail: ERDA Depository Libraries HC $4.00

Theoretical descriptions are given for plasma-vacuum systems for the following three cases: (1) equilibrium with external conductors, (2) perturbed equilibria, and (3) neighboring equilibria. NSA

N76-24016# California Univ., Livermore. Lawrence Livermore Lab.
SPECTRAL MEASUREMENTS OF ELECTRONS AND X RAYS EMITTED FROM PLASMAS PRODUCED USING A 1.06-MU m LASER
K. G. Tirsell, H. N. Kornblum, H. C. Catron, and V. W. Slivinsky 17 Oct. 1975 13 p
(Contract W-7405-eng-48)
(UCID-16944) Avail: NTIS HC $4.50

Absolute spectral measurements were made of electrons escaping from plasmas produced by focusing 5-10 j, 50-100 ps, 1.06 mu m laser pulses on 10-mu m-thick Parylene disk targets. Nine spectral bands with 3 to 7.5 keV resolution were obtained from 30 to 190 keV with a 90 deg-focusing permanent-magnet spectrometer and appropriately positioned silicon electron detectors. The X-ray spectra were measured simultaneously with the electron spectra by means of a K-edge filter technique. Elemental filters were chosen to provide nine spectral cuts from 1.5 to 88 keV. Silicon p-i-n diodes were used for the 1.5 to 17 keV portion of the spectrum and scintillator photomultiplier combinations for higher photon energies, with the 17-keV channel duplicated. Each channel had about 20 percent energy resolution, and the final spectra were unfolded by an iterative technique. NSA

N76-24017# California Univ., Livermore. Lawrence Livermore Lab.
CALCULATIONS FOR X-RAY DIAGNOSTICS IN 2XIIB
G. Garner and B. G. Logan 18 Sep. 1975 57 p refs
(Contract W-7405-eng-48)
(UCID-16939) Avail: NTIS HC $5.50

A calculation of X-ray emission in 2X2B for various plasma models is presented, comparing T/sub e/ obtained from measured X-ray transmission through various foils to T/sub e/ obtained from Thomson scattering. The three models used are: pure bremsstrahlung radiation with a full Maxwellian electron distribution; bremsstrahlung, recombination, and line radiation with impurities and a full Maxwellian electron distribution; and bremsstrahlung, recombination, and line radiation with impurities and a cutoff electron distribution. The last model was found to give temperatures most consistent with Thomson scattering and absolute intensities consistent with the intensities measured, indicating impurities and ambipolar cutoffs for electrons are present in 2X2B. Author (NSA)

N76-24018# Illinois Univ., Urbana.
COMMENTS ABOUT PROPOSED D-He-3 EXPERIMENTS IN THE TFTR
L. M. Hively and G. H. Miley 6 Oct. 1975 25 p refs
(Contract AT(11-1)-2218)
(COO-2218-40) Avail: NTIS HC $4.50

D-He3 experiments to simulate DT burns in TFTR have been proposed by members of the Fusion Studies Center at the

University of Illinois. Some basic considerations, involved in planning these experiments, are discussed along with important results to be obtained from such measurements. It is argued that fusion product orbits, instabilities, and other phenomena can be investigated by D-He3 simulation of DT burns, before the TFTR is contaminated by tritium. This approach will allow changes in experimental design before subsequent DT burn studies. Author (NSA)

N76-24019# Oak Ridge National Lab., Tenn.
CALCULATION RESULTS ON DYNAMICS OF HELICAL MHD: INSTABILITY
N. I. Gerlach and N. M. Zueva 1973 9 p refs Transl. into ENGLISH from the Russian
(ORNL-tr-4029; Preprint-91) Avail: NTIS HC $4.50

Dynamics of helical MHD-instability is numerically investigated. A simplified equilibrium cylindrical configuration is chosen, and a small resonance helical initial perturbation is given: the constant pitch value of helical magnetic field lines is the same one as for the initial perturbation. The arising motion is supposed to conserve helical symmetry. An appropriate initial-value problem is solved by means of computer. Patterns of density distribution obtained at different time moments indicate the process of the instability development to be quasiperiodical. At initial stage of the process, vacuum bubbles are coming into the plasma. Further the surfaces of constant density form a fibrous structure.
Author (ERA)

N76-24020# Oak Ridge National Lab., Tenn.
MULTI-FLUID TOKAMAK TRANSPORT MODELS
J. T. Hogan Nov. 1975 60 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5153) Avail: NTIS HC $5.45

The following topics are discussed: (1) development of one-dimensional transport codes, (2) description of Tokamaks, (3) survey of codes, (4) commonly used moment equations, (5) relevant physical processes, (6) transport by collisional diffusion and turbulence, (7) methods used to solve the diffusion problem, (8) trapping and thermalization, (9) numerical treatment, (10) models for neutral gas, and (11) numerical solution. ERA

N76-24021# Oak Ridge National Lab., Tenn.
RESONANT ELECTRON EFFECTS ON TRAPPED ELECTRON INSTABILITIES
P. J. Catto, K. T. Tsang, J. D. Callen, and W. M. Tang Nov. 1975 14 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5158) Avail: NTIS HC $4.00

The importance of retaining resonant electron contributions when considering trapped electron instabilities has recently been noted. The necessity of distinguishing between perpendicular and parallel components in electron velocity space, rather than simply considering energy is pointed out and employed to estimate the effects of finite collisionality. For much of the banana regime the dominant resonant electron contributions are shown to be due to circulating electrons with parallel velocities in the vicinity of and slightly below the electron thermal speed. Author

N76-24022# Princeton Univ., N.J. Plasma Physics Lab.
OSCILLATING TWO-STREAM INSTABILITY AT THE RESONANCE OF OBLIQUELY INCIDENT RADIATION IN INHOMOGENEOUS PLASMAS
Y. Y. Kuo, C. Oberman, C. S. Liu, and F. Troyon Oct. 1975 26 p refs
(Contract E(11-1)-3073)
(MATT-1162) Avail: NTIS HC $4.00

The growth rate and the threshold value were calculated for the oscillating two-stream instability for an electromagnetic wave obliquely incident on an inhomogeneous plasma. The localization of the instability is found to be in the overdense region near the threshold and to shift toward the local plasma resonance when the pump intensity increases. Author (ERA)

N76-24023# Princeton Univ., N.J. Plasma Physics Lab.
RESISTIVE INSTABILITIES IN A TOKAMAK
A. H. Glasser, J. M. Greene, and J. L. Johnson Oct. 1975 30 p refs
(Contract E(11-1)-3073)
(MATT-1163) Avail: NTIS HC $5.00

Application of resistive instability theory shows that toroidal effects can stabilize the tearing mode in devices like the Princeton large torus. Contraction of the current channel is destabilizing. Finite fluid compressibility is crucial to this phenomenon.
Author (NSA)

N76-24024# Rochester Univ., N.Y.
[APPLICATION OF ASYMPTOTIC THRESHOLD NONLINEAR THEORY TO PLASMAS AND MAGNETIC FIELDS] Annual Progress Report
Albert Simon 19 Sep. 1975 13 p refs
(Contract E(11-1)-3497)
(COO-3497-13) Avail: NTIS HC $3.50

Considerable success has been achieved this year in research aimed at extending the asymptotic threshold nonlinear theory to plasmas governed by the Vlasov equation and in a group of linear studies concerned with drift instabilities in sheared magnetic fields. The nonlinear results are general and have been applied to the bump-on-tail instability and to the collisionless drift and the dissipative trapped electron instability in unsheared fields. The linear studies have dealt with the effects of resonant electrons, finite collisionality, finite-beta, neoclassical modifications and ion gyro-motion on trapped electron instabilities in sheared magnetic fields. Author (ERA)

N76-24025# Commissariat a l'Energie Atomique, Grenoble (France).
PARAMETRICALLY UNSTABLE ION SOUND WAVES
E. Canobbio May 1975 25 p refs
(EUR-CEA-FC-770) Avail: ERDA Depository Libraries HC $4.50

The dispersion relation is derived for parametric instabilities caused by an intense ion sound wave which couples high and low frequency electrostatic modes of a nonisothermal unmagnetized homogeneous plasma. The phase velocity of the pump wave is between the ion and the electron thermal speed. The dispersion relation contains filamentational, modulational, and stimulated scattering instabilities. Growth rates as a function of the pump and plasma characteristics are given. For a given amplitude of the pump, the largest growth rate is found in the case of filamentation instability which becomes explosive in nature. The relevance of this and other more general parametric instabilities from the point of view of plasma heating and confinement is briefly discussed. Author (NSA)

N76-24026# Commissariat a l'Energie Atomique, Grenoble (France).
HOT ELECTRON TARGET PLASMAS. 1: CIRCE EXPERIMENT
R. Bardet, P. Briand, L. Dupas, C. Gormezano, G. Melin, and F. Werkoff Apr. 1975 59 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-767) Avail: ERDA Depository Libraries HC $5.50

The main parameters of the CIRCE experiment are described. The plasma is obtained by the trapping of a plasma injected in a magnetic bottle by electron heating at cyclotron resonance. The plasma density lies between 5 x 10 to the 11th power cm/3 and 10 to the 12th power cm/3, the electron temperature is about 100 keV and the ion temperature in the range of few hundred eV. Gross instabilities are not observed. The ratio of the plasma density to the neutral gas density inside the plasma is higher than 100. Few kilowatts of RF power at 8 GHz are sufficient to get these results which looks to be encouraging for the creation of a more performing fast neutral plasma target using the CIRCE experiment concept. Author (NSA)

N76-24027# California Univ., Livermore. Lawrence Livermore Lab.
BOUNCE-AVERAGED KINETIC EQUATIONS
M. E. Rensink 15 Oct. 1975 16 p refs
(Contract W-7405-eng-48)
(UCID-16947) Avail: NTIS HC $4.00

The equations and definitions which enter into the bounce-average kinetic description of a mirror-confined plasma are summarized. The effects of time- and space-dependent ambipolar potentials and magnetic fields, as well as anisotropic

Rosenbluth potentials are considered. The final result is a bounce-averaged kinetic equation which is written in conservation form. Boundary conditions and a normal mode equation are also given here. Author (NSA)

N76-24028# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).

PROSPECTS FOR ION TEMPERATURE MEASUREMENTS IN JET BY THOMSON SCATTERING OF SUBMILLIMETRE WAVES

L. B. Whitbourn Mar. 1975 21 p Presented at the Workshop on Diagnostics and Data Acquisition for JET, Fontenay-aux-Roses, France, 4-5 Feb. 1975

(EUR-CEA-FC-766; Conf-750243-1) Avail: ERDA Depository Libraries HC $4.25

The use of Thomson scattering for measurements on the JET Tokamak is discussed. The principal concern is the practical limitations imposed by the availability of high power pulsed sources and sensitive detectors, and noise due to plasma emission at submillimeter wavelengths. Coherent scattering from plasma waves (ion acoustic waves and electron drift waves) with millimeter and submillimeter waves is considered. NSA

N76-24029# Addis Translations International, Portola Valley, Calif.

COMPRESSION OF A DENSE TOROIDAL PLASMA WITH BETA GREATER THAN 1 BY A GAS PISTON

R. Kh. Kurtmullaev, A. L. Lunin, and V. N. Semenov Nov. 1975 17 p refs Transl. into ENGLISH "Szmatiye Plotnoy Toroidalnoy Plazmy S beta > 1 Gazovym Porshnem" Moscow, I. V. Kurchatov Inst. of Atomic Energy Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab. Sponsored by ERDA

(UCRL-Trans-10954) Avail: NTIS HC $4.50

A method is considered for creating a toroidal plasma in a system with nonmagnetic confinement. The process of gas breakdown, formation of the toroidal structure, and heating of the plasma takes place in two stages. Initially, a gas pressure is created in the chamber in the range corresponding to the usual conditions for a gas discharge. The gas breaks down, a closed magnetic structure forms, and initial heating to a temperature of 1 to 2 KeV takes place. Some Calculations are described. NSA

N76-24030# Naval Research Lab., Washington, D.C.

EXCITATION OF LOWER HYBRID WAVES IN A PLASMA BY ELECTRON BEAMS Interim Report

K. Papadopoulos and P. Palmadesso Nov. 1975 10 p refs (NRL Proj. H02-37)

(AD-A018233; NRL-MR-3156) Avail: NTIS CSCL 20/9

Plasmas physics, electrostatic fields, electron beams, Tokamaks, excitation, ions, heating, hybrid systems, electromagnetic radiation lower hybrid waves, and the linear theory of excitation of electrostatic lower hybrid waves by electron beams are presented. The importance of such waves in Tokamaks with runaway electrons is discussed. Author (GRA)

N76-24031# Naval Research Lab., Washington, D.C.

IMPURITY TRANSPORT IN CYLINDRICAL PLASMAS Final Report

H. W. Bloomberg (Science Applications, Inc., La Jolla, Calif.), J. P. Boris, and B. Hui (Maryland Univ., College Park) Nov. 1975 45 p refs Sponsored in part by ERDA and Navy

(NRL Proj. H02-37)

(AD-A018293; NRL-MR-3155) Avail: NTIS CSCL 20/9

A 1-D plasma transport code for cylindrical geometries is presented. The code is particularly well suited for configurations where magnetic flux surfaces are in rapid motion as in conducting liner experiments. A multi-species flux plasma model is derived, and, in particular, the cross magnetic field drifts of high Z impurity ions are considered. The code is based on a finite difference scheme involving numerical Lagrangian cells that move with the E X B drift velocity. The motion of the cells is determined by the pressure balance requirement. In each time step dissipative effects are considered separately, so that the pressure adjustment can be treated as an ideal adiabatic process. Test run results of the ideal adiabatic compression of a plasma by an infinitely conducting liner are given to show the effectiveness of the pressure adjustment algorithm. The effects of classical transport have been included in a test run of the evolution of a Tokamak type plasma with PLT parameters. A modest penetration of iron ions toward the center of the plasma column is found. An algorithm for neutral particle streaming into the plasma from the wall is described. Author (GRA)

N76-24032# Illinois Univ., Urbana. Coordinated Science Lab.

EXPERIMENTAL STUDY OF WAVE-PARTICLE INTERACTIONS IN A BEAM-PLASMA SYSTEM Ph.D. Thesis

Peter Lee Taylor Sep. 1975 95 p refs Sponsored in part by Joint Services Electronics Program and General Electric

(Contract DAAB07-72-C-0259)

(AD-A018479; R-690; UILU-ENG-75-2225) Avail: NTIS CSCL 20/9

The beam-plasma instability and in particular the heating of the beam by the instability are explored experimentally for the case of a cold beam in a cold, collisional plasma. Both the instability resulting from spontaneously excited waves and the instability resulting from modulation of the beam before it enters the plasma are examined. GRA

N76-24033# Technische Hochschule, Darmstadt (West Germany).

NEUTRON, ION AND ELECTRON-ENERGY-SPECTRA IN A 1 kJ PLASMA FOCUS Final Report, 1 Jun. 1972 - 31 Aug. 1975

H. Krompholz, L. Michel, K. H. Schoenbach, and Heinz Fischer Oct. 1975 29 p refs

(Grant AF-AFOSR-2402-72; AF Proj. 9767)

(AD-A018803; EOARD-TR-75-21) Avail: NTIS CSCL 20/9

The neutron energy spectrum (4 Torr deuterium) was determined from 30 m flight histograms. An average energy of approximately 125 keV of the neutron producing deuterons within an assumed cone angle approximately 40 degrees along the z-axis was calculated by means of the target beam model. Substantial neutron production extends more than 10 cm beyond the 1 cm long focus and propagates with a 3 to 5 x 10 to the 8th cm/s velocity corresponding to a greater than 100 keV ion energy. Time of flight analysis confirms an ion spectrum extending from less than 70 to greater than 400 keV. The electron spectrum in 8 Torr hydrogen was derived from the hard X-radiation and agrees with the ions for energies greater than 150 keV. GRA

N76-24034# Science Applications, Inc., McLean, Va.

STUDIES AND CODE DEVELOPMENT FOR HIGH TEMPERATURE PLASMAS Final Report

Ellis Hyman Nov. 1975 380 p refs

(Contract N00014-75-C-0481)

(AD-A019478; SAI-151-00-371-00) Avail: NTIS CSCL 20/9

The authors discuss the studies and code development accomplished by SAI scientists in the investigation of high temperature plasmas. The work can be grouped broadly into high density plasmas produced by laser pulses or other means and low density toroidal Tokamak plasmas. These studies are of critical importance to the eventual development of thermonuclear fusion reactors as a power source. GRA

N76-24035# Naval Research Lab., Washington, D.C. Laser Plasma Branch.

FIELD GENERATION BY A GENERALIZED PONDEROMOTIVE FORCE

John A. Stamper Dec. 1975 11 p refs Sponsored in part by ERDA

(NRL Proj. H02-29A)

(AD-A019103; NRL-MR-3186) Avail: NTIS CSCL 20/9

The inclusion of absorption leads to a generalized form of the ponderomotive force which depends explicitly on the field momentum transferred to the electrons. This generalized force implies, in contrast with the usual ponderomotive force, that time-averaged magnetic fields are generated directly by the radiative forces. The growth rate of the radiatively generated magnetic fields is related simply to the time-averaged Poynting flux I and the collision frequency. The direction and magnitude of the field generation during resonance absorption are in agreement with a more detailed theory. GRA

N76-24036# Missouri Univ., Rolla. Dept. of Physics.
ATOMIC BEAM PLASMA DIAGNOSTICS Final Report, 1 Nov. 1972 - 31 Oct. 1975
Kaare J. Nygaard 11 Dec. 1975 85 p refs
(Contract N00014-69-A-041-0007; NR Proj. 099-402)
(AD-A019096) Avail: NTIS CSCL 20/9

This report is concerned with the application of atomic and ionic beams for measurement of electron density and temperature of fusion plasma. The average electron density is determined from the attenuation of an atomic beam. Spectroscopic line ratio measurements along the beam provide information about the electron temperature distribution. Single 'shot' measurements can be made and the data handling automated with an optical Multichannel Analyzer. Atomic cross sections of importance in plasma physics are discussed in two separate sessions. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-24037 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ELECTRICAL CONDUCTIVITY OF SYNTHETIC RUTILE SINGLE CRYSTALS
W. Kleber, H. Peibst, and W. Schroeder [1975] 35 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 215, no. 1/2, 1960 p 63-76 In ENGLISH and GERMAN
(BLL-M-23878-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Measurements of the electrical conductivity of rutile single crystals, synthetically grown by the Verneuil process, are expressed as functions of temperature and of degree of reduction. The conductivity behavior of the crystals was found to be very variable; for example it is possible to obtain titanium dioxide crystals, by suitable reduction, whose resistance is practically independent of temperature. It is assumed that the reduced rutile crystal is an n-semiconductor with oxygen lattice vacancies. The atomic gap distribution is discussed on the basis of structure theory, and the deduced possible distortion centers are grouped together to form an energy band diagram. Author

N76-24038 Pennsylvania State Univ., University Park.
THEORETICAL CONSIDERATIONS OF TUNNELING THROUGH THIN FILM HETEROJUNCTIONS Ph.D. Thesis
William Charles Leipold 1975 192 p
Avail: Univ. Microfilms Order No. 76-10752

An 'atomic' barrier model, developed for a metal-insulator-metal heterojunction, was studied. This one dimensional model consists of a square barrier, containing a number of uniformly spaced 'atomic' wells, between two Bohr-Sommerfeld metals. Within this model the elastic tunneling transmission coefficient was calculated without approximation for a variety of externally applied electric fields. Several approximation schemes, based on extensions of Zener's modified WKB approximation for interband tunneling, are considered. When applied to heterojunction tunneling these approximations rely on a phenomenological interpretation of the barrier region based on the bulk band structure of the insulating material. A Green's function method of calculating the eigenvalue spectrum of a thin insulating film, based on the availability of the electronic orbitals of the 'atomic' wells, is also considered. The effect of disorder on the nature of the electronic wave-function in the insulating barrier is examined within the 'atomic' barrier model. It is pointed out that none of the various modified WKB approximations, which rely on a band interpretation of the thin insulating barrier, are capable of treating the effects of disorder. The desirability of extending the 'atomic' barrier model to three dimensions is discussed. Dissert. Abstr.

N76-24039 British Library Lending Div., Boston Spa (England).
STRESS RELAXATION IN CRYSTALS WITH A CUBIC AND HEXAGONAL CLOSE PACKAGE LATTICE
L. B. Zuev and V. E. Gromov 1975 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 6, 1975 p 105-108
(BLL-M-25237-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl. 1 BLL photocopy coupon

Stress relaxation curves for alpha -Ti and NaCl crystals were analyzed by Li's method. The level of long range interval stresses was estimated and the properties and activation parameters were determined. A comparison was made with data obtained from a measurement of the velocity of dislocations, using the etch pitting method and deformation at a variable rate. The results are discussed within the framework of the theory of thermally activated processes. Author

N76-24040*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF THE AMORPHOUS STATE ON THE BAND STRUCTURE OF STEAMED COAL Ph.D. Thesis
S. Orzeszko Washington NASA May 1976 58 p refs Transl. into ENLISH from Wplyw bezpostaciowosci na strukture pasmowa wegli naparowanych (Poland), preprint 194, May 1972 p 1-80
(Contract NASw-2790)
(NASA-TT-F-17020; Preprint-194) Avail: NTIS HC $4.50 CSCL 20L

The electrical and semiconducting properties of amorphous carbon thin films are discussed, and results of experiments presented. The layers of carbon were obtained by arcing spectrally pure graphite electrodes in varying pressure concentrations of argon. Structurally the material is amorphous, with crystallite dimensions not exceeding 10 A and interatomic distances and coordination numbers being similar to those in graphite planes, in two dimensions only. Electrical conductivity is measured in relation to temperature as well as mobility gap widths and unpaired electron concentration. The basic properties of amorphous semiconductors are discussed, with the final conclusion that the carbon layers produced are typical amorphous semiconductors. Author

N76-24041*# Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
THE SOLIDIFICATION UNDER ZERO GRAVITY CONDITIONS OF BINARY ALLOYS EXHIBITING SOLID STATE IMMISCIBILITY Final Report
A. A. Johnson, R. P. Anantatmula, R. J. Horylev, S. P. Gupta, and R. S. Vatne 1 Oct. 1975 88 p refs
(Contract NAS8-29725)
(NASA-CR-144302) Avail: NTIS HC $5.00 CSCL 20L

The solidification behavior of gold-silicon alloys containing up to 25 at. % silicon was studied, and a mathematical model of gravity segregation during solidification was developed. A background of knowledge is provided which can be used in the design of zero gravity solidification experiments to be carried out in the 300-ft drop tower, in Aerobee rockets and in future space missions. Such experiments are needed to develop the basic scientific knowledge required for the design of economically viable space manufacturing processes. Some preliminary zero gravity experiments were carried out on a gold-25 at. % silicon alloy using the drop tower facility. Author

N76-24042*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FLIGHT 1 TECHNICAL REPORT FOR EXPERIMENT 74-37 CONTAINED POLYCRYSTALLINE SOLIDIFICATION IN LOW-G
John M. Papaziak and Theodoulos Z. Kattamis (Conn. Univ., Storrs) Apr. 1976 25 p refs
(Contract NAS8-31530)
(NASA-CR-144303; RM-617) Avail: NTIS HC $3.50 CSCL 20L

A .005 M solution of fluorescein in cyclohexanol was directionally solidified in a standard 10 x 10 x 45mm UV silica cuvette, using a bottom thermoelectric chilling device. Progress of the experiment was monitored by time lapse photography. During flight (SPAR I) the camera malfunctioned and only one quarter of the expected data were collected. Comparison of flight and ground specimens indicated that: (1) The dark green layer observed ahead of the solid-liquid interface which is most likely the solute-enriched zone, appears to be wider in the flight specimen; (2) Parasitic nucleation ahead of the solid-liquid interface in the flight sample led to an irregularly shaped interface, smaller grain size, equiaxed grain morphology and a larger average

macroscopic growth rate; (3) The formation of equiaxed grains ahead of the solid-liquid interface in the flight specimen may be attributed to ordered islands within the liquid, which survived remelting because of the low degree of superheating (approximately equal to 1.5 C), did not settle because of reduced gravity and acted as nuclei during cooling. Author

N76-24043*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FLIGHT 1 TECHNICAL REPORT FOR EXPERIMENT 74-36: THERMAL MIGRATION OF BUBBLES AND THEIR INTERACTION WITH SOLIDIFICATION INTERFACES
John M. Papazian and William R. Wilcox (Clarkson Coll. of Technol.) Apr. 1976 34 p refs
(Contract NAS8-31529)
(NASA-CR-144304; RM-616) Avail: NTIS HC $4.00 CSCL 20L

Specimens of gas saturated carbon tetrabromide were directionally solidified in a transparent furnace using a gradient freeze technique. The original temperature gradient was 5 C/cm and the cooling rate was 40 C/h. Progress of the experiment was monitored photographically. Gas bubbles were generated at the advancing solidification front in each of the three specimens. The gas bubbles were observed to increase in size, coalesce, and eventually be grown into the solid specimen under low gravity conditions. No bubble detachment from the interface was observed. Identical specimens processed in the laboratory showed bubble nucleation, bubble growth, and eventual bubble detachment due to buoyancy forces. Examination of the specimens showed a significantly greater void content in the low gravity processed samples. The grain size was observed to be finer in the low gravity processed samples. Author

N76-24044# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
EXPERIMENTAL ANALYSIS OF IMPURITY ENERGY LEVELS IN SEMICONDUCTORS Final Report, 1 Nov. 1970 - 30 Jun. 1974
C. R. Crowell 20 Oct. 1975 13 p refs
(Grant DA-ARO(D)-31-124-71-G34)
(AD-A018519; ARO-8792.5-EL) Avail: NTIS CSCL 20/12

The major emphasis of this investigation was intended as a clarification of the extent to which deep-lying impurity levels can be explored capacitively in metal-semiconductor systems. A simple lumped constant equivalent circuit representation was developed for a distribution of energy levels of majority carrier trapping centers in Schottky barriers. An improved electronically balanced broad band capacitance measuring system was designed, built for measurements from about 10 H z to 200 kHz. The Hf-p type Si Schottky barrier system was investigated and shown to have approximately 0.6 ev barrier height. The hole capture cross-section for In in p-type Si was measured over the temperature range 58 K to 133 K. GRA

N76-24045# Illinois Univ., Urbana. Coordinated Science Lab.
LUMINESCENT AND ELECTRICAL PROPERTIES OF SODIUM IMPLANTED ZINC SELENIDE Ph.D. Thesis
Albert Joseph Rosa Aug. 1975 218 p refs
(Contract DAAB07-72-C-0259)
(AD-A018453; R-685; UILU-ENG-75-2220) Avail: NTIS CSCL 20/12

The behavior of Na in ZnSe has been characterized and evaluated as a potential blue luminescent center. To overcome certain self-compensating limitations to achieving p-type conductivity in an otherwise n-type material, ion implantation of this species was performed. The resulting effects have been studied through low temperature photoluminescence, temperature dependent Hall effect and sheet resistivity measurements, and other electrical techniques such as electroluminescence, current-voltage and capacitance-voltage. The results have been evaluated through comparative experiments with N and Ne implanted and unimplanted material. Author (GRA)

N76-24046# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A SYMPTOTIC ELASTIC-PLASTIC TRANSITION STRESS OF SHOCKED CRYSTALLINE MATERIALS
Gerald L. Moss Oct. 1975 17 p refs
(DA Proj. 1T1-61102-A-33H)
(AD-A018449; BRL-1841) Avail: NTIS CSCL 20/11

An analysis of elastic-plastic shock yielding is presented. The analysis is based on the commonly accepted condition that the elastic-plastic transition zone is a heavily dislocated boundary. It is hypothesized that, at dislocation pile-ups at slip band intersections, the lattice can be momentarily cracked. It is shown that this condition allows an approximate determination of the asymptotic elastic-plastic transition stress. This transition stress is calculated with a plane-strain analysis of the localized inhomogeneous stress field about the incipient yield zone. Author (GRA)

N76-24047# Yeshiva Univ., New York. Belfer Graduate School of Science.
SYSTEMATIC STUDY OF PYROELECTRICITY. GENERALIZED MOLECULAR FIELD THEORY OF FERROELECTRICITY AND PYROELECTRICITY Semiannual Technical Report, 1 Oct. 1974 - 31 Mar. 1975
M. I. Bell and P. M. Raccah Oct. 1975 59 p refs
(Contract DAAB07-74-C-0470; ARPA Order 2573)
(AD-A018795; ECOM-74-0470-2) Avail: NTIS CSCL 20/2

The generalized molecular field theory of ferroelectricity developed previously by the authors is used to obtain exact expressions for the ferroelectric properties of crystals (spontaneous polarization, dielectric susceptibility, critical temperature and polarization) and for the resulting pyroelectric properties (pyroelectric coefficient and response figure of merit for radiation detection). Good agreement between theory and experiment is found for the spontaneous polarization of triglycine sulfate. The response figure of merit is found to exhibit an interesting universal behavior which may prove useful in optimizing detector performance. The well-known Devonshire formalism, obtained by truncating the power-series expansion for the free energy, is found to yield a relatively poor approximation to the results of the generalized molecular field theory. Author (GRA)

N76-24048# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
CONTINUOUS SILICON SOLAR CELLS Final Report, 1 Apr. 1973 - 28 Feb. 1975
B. Chalmers, A. I. Mlavsky, T. Surek, J. C. Suartz, and R. O. Bell Aug. 1975 195 p refs Prepared in cooperation with Mobil Tyco Solar Energy Corp.
(Grant NSF GI-37067)
(PB-247228/0; NSF/RA/N-75-122) Avail: NTIS HC $7.50 CSCL 20B

The theoretical and experimental investigations are reported of the heat flow, fluid flow, capillarity and shape controlling aspects of the process, as well as the crystal growth systems which were developed based on these studies of Si ribbon EDF (Edge Defined, Film-Fed Growth). The structural and electrical characteristics of the ribbons were investigated and the results are described. An economic analysis of ribbon growth and solar cell manufacture is presented. The major achievements are as follows: (1) identification on theoretical grounds of the parameters that control growth of silicon ribbon by EFG; (2) determination of practical limits of growth parameters; (3) improvement in crystal quality; (4) routine production of solar cells with 7 percent (simulated AMO) efficiency; 10 percent efficiency sometimes reached; (5) first approach towards correlations between growth parameters, crystal quality, electronic properties and photovoltaic quality; (6) accumulation of experience and data on which economic projections are based; and (7) economic projections for large scale production of silicon ribbon. GRA

N76-24049# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
GEOMETRIC SELECTION OF CRYSTALS
A. N. Kolmogorov Jan. 1976 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 65, no. 5, 1949 p 681-684
(AD-A019158; CRREL-TL-509) Avail: NTIS CSCL 20/2

This paper presents a mathematical theory of the geometric selection of crystals nascent on the boundary of a crystallizing mass. GRA

N76-24050# Picatinny Arsenal, Dover, N.J.
ELECTRIC FIELD EFFECTS IN ALPHA LEAD AZIDE SINGLE CRYSTALS USING Au-Au CONTACTS
D. S. Downs, T. Gora, M. Blais, and W. L. Garrett Nov. 1975 35 p refs
(AD-A018753; PA-TR-4874) Avail: NTIS CSCL 19/1

The response of single crystals of alpha-lead azide to moderately high electric fields has been investigated using Au contacts in a configuration that minimizes surface currents. Initiation is observed to occur at a threshold electric field of approximately 35,000 V/cm. Initiation cannot be attributed to bulk joule heating. The possibility that a space-charge-limited single carrier injection regime occurs at fields below the threshold field is assessed and tentatively rejected. Other possible mechanisms for the current voltage characteristics and for the observed field initiation are briefly discussed. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-24051 British Library Lending Div., Boston Spa (England).
THERMODYNAMIC DETERMINATION OF FORCES, CONTRACTING THE PARTICLES OF A LIQUID LAYER
V. A. Deryabin and S. I. Popel [1975] 17 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Chern. Met. (USSR), no. 4, 1975 p 22-26 In ENGLISH and RUSSIAN
(BLL-M-25196-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

By comparing the work, expended on an infinitely small displacement of particles in a liquid layer, with the free energy of the liquid, an equation is derived for determining the capillary cohesion of the particles. An example is considered, which illustrates the refinement of the results with the use of the proposed equation. Author

N76-24052 British Library Lending Div., Boston Spa (England).
THERMODYNAMIC ACTIVITIES OF THE COMPONENTS IN THE La-Si SYSTEM
B. P. Burylev and I. V. Ryabchikov [1975] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 4, 1975 p 13-15 In ENGLISH partly in Russian
(BLL-M-25195-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The Hildebrand-Mott equation is used to assess the activities of the components in group three metal silicon alloys. The results obtained are compared with experimental data for the Al-Si system. The method is subsequently applied to the La-Si system. Here, asymmetry detected in the thermodynamic properties is due to the nature of the relationship between the coordinate number, Z, of the solution and its properties. Relationships expressing Z and Q, the mutual exchange energy, as functions of the composition are obtained. The activitites are calculated from equations which account for the short range order in the solutions. More negative and asymmetric deviations from the laws of perfect solutions are detected in the La-Si system at 1,600 C. Author

N76-24053 British Library Lending Div., Boston Spa (England).
THE ENTROPY OF GASES IN THE CASE OF IRREVERSIBLE PROCESSES
D. Enskog [1975] 7 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 54, 1929 p 498-504
(BLL-CE-Trans-6848-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

A law of maximum possible rate of entropy increase is developed and its relationship to other principles with the same tendency is discussed. A calculation is made of the entropy of a gas which is not in a state of equilibrium. Author

N76-24054# Instituto Politecnico Nacional, Mexico City.
THERMODYNAMIC AND STATISTICAL PROPERTIES OF FLUIDS, VOLUMES 1 AND 2
Genaro De Jesus Rojas Gonzalez 1975 169 p refs In SPANISH
(NP-20571-Vol-1; NP-20571-Vol-2) Avail: ERDA Depository Libraries HC $7.75

The Mayer theory of an imperfect gas is presented from the viewpoint of the theory of linear graphics and the formalism of correlation functions. The theory of linear graphics is used to obtain expansions of the correlation functions in power series of the fugacity and density and to analyze its asymptotic behavior. The theory based on the Kirkwood superposition approximation, the hypernetted chain, and the Percus--Yevick theories are presented. These last two theories are analyzed from the viewpoint of the theory of linear graphics. The theoretical predictions are compared with experimental data for Ar and Xe and with calculations based on the Monte Carlo method. ERA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-24055# Committee on Science and Technology (U. S. House).
OVERSIGHT HEARINGS ON NATIONAL SCIENCE FOUNDATION SCIENCE EDUCATION PROGRAMS
Washington GPO 1975 225 p Hearings before Subcomm. on Sci., Res., and Technol. of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 26, 29-30 Jan. 1975
(GPO-47-832) Avail: Subcomm. on Sci., Res. and Technol.

The science education programs of the National Science Foundation, and their past and future role in maintaining and strengthening science education in the United States are examined. Factors considered include: the status of science education; basis for the reductions and restrictions imposed on the Foundation by the Office of Management and Budget; the role of the teaching and research communities in directing a support activities; and programs which will be of most value to schools, high schools, colleges, and universities. J.M.S.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-24056 British Library Lending Div., Boston Spa (England).
EXPERIENCE AND DEVELOPMENT OF AN AUTOMATIC SYSTEM FOR TECHNICAL AND ECONOMIC PLANNING AT WORKS
A. G. Karpov, A. A. Semin, I. I. Usacheva, and I. I. Mikhailyuk 1975 15 p refs Transl. into ENGLISH from Stal. (USSR), v. 5, 1975 p 461-464
(BLL-M-25217-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The types of problems solved by the Minsk-22 computer are given, and the introduction of automatic systems for technical and economic planning are discussed. The type of problems are: (1) analysis of operative information for running shops and individual plants; (2) planning, calculating and analyzing costs; (3) calculating and analyzing production and sales; (4) statistical analysis of the technical and economic particulars of steelmaking; and (5) calculation of sales of commercial products and profits. F.O.S.

N76-24057# National Academy of Sciences - National Research Council, Washington, D.C. Ad Hoc Panel on Experimental R and D Incentives
NEW EXPERIMENTS IN RESEARCH AND DEVELOPMENT INCENTIVES Final Report
Jun. 1975 31 p ref
(Contract NSF C-310)
(PB-248193/5; AE/ERDIP-001) Avail: NTIS HC $4.00 CSCL

05A

An evaluation of the NSF program on experimental research and development incentives is given. Demand articulation (provides funds through state governments for innovative technology planning by municipalities) investment incentives (interactions with federal agencies whose activities influence availability of capital for innovative enterprises), and research application (longitudinal study of federal agencies' methods for stimulating transfer of their R and D results into the public marketplace) are among the factors discussed. GRA

N76-24058# Air Force Business Research Management Center, Wright-Patterson AFB, Ohio.

AN ANALYSIS OF APPEALED AIR FORCE CONTRACT DISPUTES Final Independent Study

Paul E. Newman Nov. 1975 75 p refs

(AD-A018606; AFBRMC-I-3-1-74) Avail: NTIS CSCL 05/1

The objective of this study was to provide a synthesis of appealed contract disputes and to identify the relationships of the key variables which cause disputes in Air Force contracts. Using data from 180 FY-74 ASBCA Appeal Data Reports, an attempt was made to investigate relationships among eight variable types (major command, award method, contract type, procurement type, party of interest, principal clause, contract amount, and claim amount). Considerable effort was directed toward constructing 28 chi-square contingency tables and the results are discussed. GRA

N76-24059# Assistant Secretary of Defense (Systems Analysis), Washington, D.C.

PROCEEDINGS OF THE 19TH ANNUAL DEPARTMENT OF DEFENSE COST ANALYSIS SYMPOSIUM

25 Sep. 1974 68 p refs Symp. held at Airlie, Vir., 22-25 Sep. 1974

(AD-A019185) Avail: NTIS CSCL 05/1

Contents: Relationships between the Congress and Department of Defense; Congressional Budget and Impoundment Control Act of 1974; Cost data problems; Inflation Considerations in weapon systems costs; Personnel costing; Design to cost (DTC) and life cycle cost (LCC) implications; Operations and support costs; Acquisition cost estimating; Economic analysis and program evaluation. GRA

N76-24060# Defense Communications Engineering Office, Reston, Va.

DCS FIVE-YEAR PROGRAM (FYP) PRIORITY METHODOLOGY

Gary Dew Dec. 1975 49 p refs

(AD-A019515; TN-46-75) Avail: NTIS CSCL 05/1

Eight priority methodologies that could be used for the DCS Five Year Program (FYP) are discussed, evaluated and compared. These are: purpose/function, popularity, programmatic/technological, cost-savings, utility, systems effectiveness, macro-systems, and composite. A priority system in the FYP is required in order to recognize and fund the more important programs and projects. The most likely candidate methodology is the composite priority methodology. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-24061 British Library Lending Div., Boston Spa (England).

METADEX SYSTEM: RESULTS OF A TEST

Anni Brandstatter Jan. 1976 10 p Transl. into ENGLISH from Deut. Ges. fuer Metallkunde Ev. (Germany), 1974

(BLL-RTS-9841) Avail: British Library Lending Div., Boston Spa, Engl.: 8 BLL photocopy coupons

The METADEX system was tested for comprehensiveness and relevance with special regard to German-speaking users. Results are presented. Author

N76-24062# California Univ., Livermore. Lawrence Livermore Lab.

DATA BASE DESIGN FOR DIGITAL DESIGN AUTOMATION

M. N. Matelan and R. J. Smith, II 12 May 1975 16 p refs Presented at the ACM Assoc. of Computing Machinery, Minneapolis, 20 Oct. 1975 Sponsored by ERDA

(UCRL-76838; Conf-751014-2) Avail: NTIS HC $4.00

Data organization is perhaps the most important aspect of any design automation system. A data base designed and presently in use at the Lawrence Livermore Laboratory is described. Utilization of the data base by application subsystems is also described. The routines used to access, update, and manipulate the data base are known as the DB manager; particular attention is directed to the DB Kernel, the DB Access Utilities, the DB Manipulation Utilities, and the DB Buffers. ERA

N76-24063# California Univ., Livermore. Lawrence Livermore Lab.

DATA BASE DESIGN FOR DIGITAL DESIGN AUTOMATION

M. N. Matelan and R. J. Smith, II 24 Jul. 1975 10 p refs Presented at the Workshop on Data-Bases for Interactive Design, Waterloo, Ontario, 15-16 Sep. 1975 Sponsored by ERDA

(UCRL-76838-Rev-1; Conf-750936-1) Avail: NTIS HC $4.00

For abstract, see N76-24062.

N76-24064# Atlantic Analysis Corp., Norfolk, Va.

TAC D AND E PROGRAM INFORMATION BASE Final Report, 1 Mar. - 30 Sep. 1975

Richard C. Hanford 30 Nov. 1975 26 p

(Contract N00014-75-C-0745)

(AD-A018708; AAC-105-75-1) Avail: NTIS CSCL 05/2

Requirements for documentation of tactical information within the TAC D and E Program are not being met today and the situation is not likely to improve without special efforts on the part of all participants. A common evaluation framework for TAC D and E efforts and information is fundamental to the success of such efforts. A feasible framework to this end is proposed. If implemented to support project efforts, it appears that a separate effort to provide a relevant corporate memory is not required. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-24065# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SPEECH UNDERSTANDING SYSTEMS Quarterly Technical Progress Report, 1 Aug. - 29 Oct. 1975

William A. Woods, M. Bates, G. Brown, Bertram Bruce, and Craig Cook Nov. 1975 116 p refs

(Contract N00014-75-C-0533; ARPA Order 2904)

(AD-A018683; BBN-3188; QTPR-4) Avail: NTIS CSCL 05/7

This report describes recent progress of the BBN speech understanding. The BBN speech understanding project is an effort to develop a continuous speech understanding system which uses syntactic, semantic and pragmatic support from higher level linguistic knowledge sources to compensate for the inherent acoustic indeterminacies in continuous spoken utterances. These knowledge sources are integrated with sophisticated signal processing and acoustic-phonetic analysis of the input signal, to produce a total system for understanding continuous speech. The system contains components for signal analysis, acoustic parameter extraction, acoustic-phonetic analysis of the signal, phonological expansion of the lexicon, lexical matching and retrieval, syntactic analysis and prediction, semantic analysis and prediction, pragmatic evaluation and prediction, and inferential fact retrieval and question answering, as well as synthesized text or spoken output. The report summarizes the fourth year of a five-year development effort. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-24066# Committee on Interior and Insular Affairs (U. S. Senate).
FEDERAL COAL LEASING AMENDMENTS ACT OF 1975
Washington GPO 1975 682 p refs Hearings on S. 391 before Subcomm. on Minerals, Materials and Fuels of Comm. on Interior and Insular Affairs, 94th Congr., 1st Sess., 7-8 May 1975
(GPO-53-918) Avail: Subcomm. on Minerals, Materials and Fuels

Hearings held before the subcommittee on minerals, materials and fuels of the Committee on Interior and Insular Affairs of the U.S. Senate on the Federal Coal Leasing Amendments Act of 1975 were reported. The proposed bill (S.391) would make six basic changes in the Mineral Leasing Act of 1920: (1) coal leases would be issued by competitive bidding only, (2) leases would be issued after adoption of comprehensive land use plans, (3) prospecting permits and preference right leases would be eliminated, (4) coal leases would be for a specified term of 20 years and so long thereafter as coal is produced in paying quantities, (5) lessees would have to submit development and reclamation plans one year after obtaining a coal lease, and (6) the revenue-sharing provision of the Mineral Leasing Act of 1920 would be amended to broaden the purposes for which the States can use their share of coal-leasing revenues. Y.J.A.

N76-24067# Committee on Interior and Insular Affairs (U. S. Senate).
OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS AND COASTAL ZONE MANAGEMENT ACT AMENDMENTS, PART 1
Washington GPO 1975 700 p refs Joint Hearings pursuant to S. Res. 45 and S. Res. 222 before Comm. on Interior and Insular Affairs and Comm. on Commerce, 94th Congr., 1st Sess., 14, 17-18 Mar. 1975
(GPO-49-982) Avail: Comm. on Interior and Insular Affairs

Bills dealing with Federal outer continental shelf oil and gas development and its impact on the coastal zone are considered. Economic, social, and environmental effects, both on the ocean and its resources and onshore are examined. J.M.S.

N76-24068 Committee of Conference (U. S. Congress).
PETROLEUM PRICING REVIEW ACT
Washington GPO 1975 17 p Rept. to accompany H.R. 4035, 94th Congr., 1st Sess., 14 Jul. 1975
(H-Rept-94-356; GPO-57-006) Avail: US Capitol, House Document Room

This act provides for Congressional review and optional disapproval of proposals to remove price ceilings or to raise the price of domestic oil. An interim extension of certain energy authorities is also included. The text of the bill and an explanation of its contents are presented. D.M.L.

N76-24069*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
BROADCASTING SATELLITES AND INTERNATIONAL LAW: A NEW COMMUNICATIONS TECHNOLOGY AND ITS WORLDWIDE LEGAL CONSEQUENCES
Ulrich Thieme Washington NASA May 1976 153 p refs Transl. into ENGLISH from Rundfunksatelliten und internationales Recht. Eine neue Kommunikationstechnik und ihre weltweiten rechtlichen Auswirkungen (USSR), Publ. no. 72, 1973 p 1-117
(Contract NASw-2789)
(NASA-TT-F-16843; Publ-72) Avail: NTIS HC $6.75 CSCL 05D

The international legal questions associated with communication at a global level via direct broadcasting satellites and distribution satellites were examined. A thorough review of past efforts and accomplishments in this regard, as well as of the current situation, is presented, including a detailed analysis of costs and technical problems. Particular emphasis is placed on difficulties which may be encountered with respect to the allocation of frequencies, the right of access of third nations to satellites of other nations, regulation of program content and 'pirate' transmitters, and questions concerned with copyright and liability for damage. Based on the above analysis, a new 'world law', which takes into account the emerging world community and suggests 'mankind' as a new legal entity is proposed. Numerous references are provided. Author

N76-24070# Committee on Public Works (U. S. House).
ALLOTMENT OF GRANT FUNDS FOR THE FISCAL YEARS ENDING 30 SEPTEMBER 1977 AND 30 SEPTEMBER 1978 FOR THE CONSTRUCTION OF PUBLICLY OWNED WASTE-WATER TREATMENT WORKS
Washington GPO May 1976 6 p Prepared for Comm. on Public Works and Transportation, 94th Congr., 2d Sess., May 1976
(GPO-69-244) Avail: Comm. on Public Works and Transportation

Federal budgets are outlined for water treatment facilities and projects on a statewide basis. Statistical population projections for the year 1990 are given. J.R.T.

N76-24071# Committee on Science and Technology (U. S. House).
ERDA AUTHORIZATION. PART 6: 1976 AND TRANSITION PERIOD ENVIRONMENT AND SAFETY
Washington GPO 1975 843 p refs Hearings before Subcomm. on Energy Res., Development and Demonstration (fossile fuels) and the Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 4, 26 Feb. 1975
(GPO-54-199) Avail: Subcomm. on Energy Res., Development and Demonstration

The hearings are reported concerning the budget authorization for ERDA relating to environment and safety in the fossil fuel area. Topics discussed include: ERDA organization, operational safety, development of biomedical and environmental research budget, energy technologies, human research, coal and synthetic fuels, and gas and oils. F.O.S.

N76-24072# Committee on Science and Technology (U. S. House).
A PROPOSED NATIONAL SCIENCE POLICY AND ORGANIZATION ACT OF 1975
1975 62 p
(PB-248384/0) Avail: NTIS MF $2.25 CSCL 05A

A bill intended to be a stepping stone toward the implementation of a statutory science policy is proposed. Four important devices are suggested in this legislation: a comprehensive statement of national policy for Science and Technology to help crystallize and effect policy at the highest levels of government; a Department of Research and Technology Operations to bring together certain Federal research-related activities through a unified and efficient governmental structure; and a Science and Technology Information and Utilization Corporation to promote full, prompt and efficient access by the public to the benefits of research and development. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-24073*# Southeastern Oklahoma State Univ., Durant. Technology Use Studies Center.
TECHNOLOGY UTILIZATION IN A NON-URBAN REGION: FURTHER IMPACT AND TECHNIQUE OF THE TECHNOLOGY USE STUDIES CENTER (6) Final Report
Henry C. Gold, A. M. Moore, Bill Dodd, and Susan G. West Jan. 1976 175 p refs
(Contract NASw-2629)
(NASA-CR-147147) Avail: NTIS HC $6.75 CSCL 05A

The activities of the TU Center are reported. Areas reported include: TUSC clientele informaton, dissemination and assistance, faculty information service, and cooperation with other agencies. The general aviation news letter is included along with transfer and impact reports. F.O.S.

N76-24074*# University of Southern Calif., Los Angeles. Graduate School of Business Administration.
HIGHLIGTS OF THE CONTRACT YEAR, 1 FEBRUARY 1974 TO 31 JANUARY 1975 Final Progress Report
Jan. 1975 15 p
(Contract NASw-2592)
(NASA-CR-147148) Avail: NTIS HC $3.50 CSCL 05A

Two major marketing programs were initiated during 1974: (1) the unlimited search plan, and (2) the sales representative plan for northern California. The unlimited search plan was a six month program designed to offer clients multiple searches for a fixed fee. Although initial response was quite favorable, interest waned, and the plan was not renewed. Expansion and improvement of the on-line retrieval service continued. The ERIC thesaurus was added to the system. This thesaurus is an important acquisition as it gives the user greater flexibility in determining the best strategy for his search. Total terminal output time was reduced with a change to the direct access work file. J.A.M.

N76-24075*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORATION SYSTEMS. VOLUME 1: SUMMARY REPORT
Mar. 1976 33 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137864) Avail: NTIS HC $4.00 CSCL 13F

Technical, economic, environmental, and sociopolitical issues associated with future intercity transportation system options were assured. Technology assessment was used as a tool to assist in the identification of basic research and technology development tasks that should be undertaken. The emphasis was on domestic passenger transportation, but interfaces with freight and international transportation were considered. Author

N76-24076*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORATION SYSTEMS. VOLUME 2: IDENTIFICATION OF ISSUES AFFECTING INTERCITY TRANSPORTATION
Mar. 1976 503 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137865) Avail: NTIS HC $12.75 CSCL 13F

Papers on major issues and trends that affect the future of intercity transportation are presented. Specific areas covered include: political, social, technological, institutional, and economic mechanisms, the workings of which determine how future intercity transporation technologies will evolve and be put into service; the major issues of intercity transportation from the point of view of reform, including candidate transporation technologies; and technical analysis of trends affecting the evolution of intercity transportation technologies. Author

N76-24077*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORTATION SYSTEMS. VOLUME 3: TECHNOLOGICAL CHARACTERISTICS OF FUTURE INTERCITY TRANSPORTATION MODELS
Mar. 1976 199 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137866) Avail: NTIS HC $7.50 CSCL 13F

Overall and specific information about the technological characteristics of present, future, and possible future technological forms of transportation modes are presented. Author

N76-24078*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORTATION SYSTEMS. VOLUME 4: SCENARIOS
Mar. 1976 186 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137867) Avail: NTIS HC $7.50 CSCL 13F

Four background scenarios that relate to alternative states of society in the next 25 to 50 years are described. The scenarios were developed for use in analyzing and evaluating alternative future intercity transportation technologies. The scenarios are based, in part, on discussions contained in the issue papers and, in part, on separate analysis of social and economic trends considered relevant for the evolution of intercity transportation. Author

N76-24079*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORTATION SYSTEMS. VOLUME 5: WORKSHOP PROCEEDINGS
Mar. 1976 129 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137868) Avail: NTIS HC $6.00 CSCL 13F

Proceedings of a workshop conducted to identify and debate issues and impacts related to future transporation alternatives are presented. Results of the technology assessment of intercity transportation are reviewed. J.M.S.

N76-24080*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORTATION SYSTEMS. VOLUME 6: IMPACT ASSESSMENT
Mar. 1976 44 p Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137869) Avail: NTIS HC $4.00 CSCL 13F

Consequences that might occur if certain technological developments take place in intercity transportation are described. These consequences are broad ranging, and include economic, environmental, social, institutional, energy-related, and transportation service implications. The possible consequences are traced through direct (primary) impacts to indirect (secondary, tertiary, etc.) impacts. Chains of consequences are traced, reaching as far beyond the original transportation cause as is necessary to identify all impacts felt to be influenced significantly by the technological development considered. Author

N76-24081*# Peat, Marwick, Mitchell and Co., Burlingame, Calif.
TECHNOLOGY ASSESSMENT OF FUTURE INTERCITY PASSENGER TRANSPORTATION SYSTEMS. VOLUME 7: STUDY RECOMMENDATIONS
Mar. 1976 68 p refs Sponsored in part by DOT Prepared in cooperation with Calif. Univ., San Diego, Stanford Univ., Calif., Gellman Res. Assoc., Inc., Jenkintown, Pa., and Science Applications, Inc., Los Angeles 7 Vol.
(Contract NAS2-8730)
(NASA-CR-137870) Avail: NTIS HC $4.50 CSCL 13F

Research and analysis tasks to alleviate negative impacts, to augment positive impacts, or to better understand the impacts produced by the potential introduction of the alternate transportation technologies are identified. The project team's recommenda-

tions on research and analysis efforts which have resulted from the technology assessment are provided. Many of the recommendations apply to the future supply of intercity passenger transportation services, categorized by mode. Other recommendations pertain to broad issues in intercity transportation--e.g., finance, regulation, traveler values--that will affect all modes.
Author

N76-24082*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INITIAL COMPARISONS OF MODULAR-SIZED, INTEGRATED UTILITY SYSTEMS AND CONVENTIONAL SYSTEMS FOR SEVERAL BUILDING TYPES
Harold E. Benson and Leo G. Monford, Jr. Apr. 1976 90 p
(NASA-TM-X-58140; JSC-09076) Avail: NTIS HC $5.00

The results of a study of the application of a modular integrated utility system to six typical building types are compared with the application of a conventional utility system to the same facilities. The effects of varying the size and climatic location of the buildings and the size of the powerplants are presented. Construction details of the six building types (garden apartments, a high rise office building, high rise apartments, a shopping center, a high school, and a hospital) and typical site and floor plans are provided. The environmental effects, the unit size determination, and the market potential are discussed. The cost effectiveness of the various design options is not considered.
Author

N76-24083*# Columbia Univ., New York.
ECONOMIC IMPACT OF LARGE PUBLIC PROGRAMS: THE NASA EXPERIENCE
Eli Ginzburg, James W. Kuhn, Jerome Schnee, and Boris Yavitz Mar. 1976 176 p refs
(Grant NGR-33-008-168)
(NASA-CR-147952; ISBN-0-913420-68-9) Avail: NTIS HC $7.50 CSCL 05A

The economic impact of NASA programs on weather forecasting and the computer and semiconductor industries is discussed. Contributions to the advancement of the science of astronomy are also considered.
D.M.L.

N76-24084*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PATROL FORCE ALLOCATION FOR LAW ENFORCEMENT: AN INTRODUCTORY PLANNING GUIDE
Robert L. Sohn and Robert D. Kennedy 16 Feb. 1976 51 p refs Sponsored in part by US Dept. of Justice
(Contract NAS7-100)
(NASA-CR-147948; JPL-5040-18) Avail: NTIS HC $4.50 CSCL 05A

Previous and current methods for analyzing police patrol forces are reviewed and discussed. The steps in developing an allocation analysis procedure are defined, including the prediction of the rate of calls for service, determination of the number of patrol units needed, designing sectors, and analyzing dispatch strategies. Existing computer programs used for this purpose are briefly described, and some results of their application are given.
Author

N76-24085*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTI-COMMUNITY COMMAND AND CONTROL SYSTEMS IN LAW ENFORCEMENT: AN INTRODUCTORY PLANNING GUIDE
Robert L. Sohn, E. A. Garcia, and Robert D. Kennedy 31 Mar. 1976 85 p Sponsored in part by US Dept. of Justice
(Contract NAS7-100)
(NASA-CR-147949; JPL-5040-19) Avail: NTIS HC $5.00 CSCL 05A

A set of planning guidelines for multi-community command and control systems in law enforcement is presented. Essential characteristics and applications of these systems are outlined. Requirements analysis, system concept design, implementation planning, and performance and cost modeling are described and demonstrated with numerous examples. Program management techniques and joint powers agreements for multicommunity programs are discussed in detail. A description of a typical multi-community computer-aided dispatch system is appended.
Author

N76-24086*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF COMPUTER-AIDED DISPATCH IN LAW ENFORCEMENT: AN INTRODUCTORY PLANNING GUIDE
Robert L. Sohn, R. M. Gurfield, E. A. Garcia, and J. E. Fielding 19 Dec. 1975 88 p refs Sponsored in part by US Dept. of Justice
(Contract NAS7-100)
(NASA-CR-147920; JPL-5040-16) Avail: NTIS HC $5.00 CSCL 05A

A set of planning guidelines for the application of computer-aided dispatching (CAD) to law enforcement is presented. Some essential characteristics and applications of CAD are outlined; the results of a survey of systems in the operational or planning phases are summarized. Requirements analysis, system concept design, implementation planning, and performance and cost modeling are described and demonstrated with numerous examples. Detailed descriptions of typical law enforcement CAD systems, and a list of vendor sources, are given in appendixes.
Author

N76-24087*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF AUTOMATIC VEHICLE LOCATION IN LAW ENFORCEMENT: AN INTRODUCTORY PLANNING GUIDE
G. R. Hansen and W. G. Leflang 15 Jan. 1976 52 p refs Sponsored in part by US Dept. of Justice
(Contract NAS7-100)
(NASA-CR-147921; JPL-5040-17) Avail: NTIS HC $4.50 CSCL 05A

A set of planning guidelines for the application of automatic vehicle location (AVL) to law enforcement is presented. Some essential characteristics and applications of AVL are outlined; systems in the operational or planning phases are discussed. Requirements analysis, system concept design, implementation planning, and performance and cost modeling are described and demonstrated with numerous examples. A detailed description of a typical law enforcement AVL system, and a list of vendor sources are given in appendixes.
Author

N76-24088*# Chase Econometric Associates, Inc., Bala Cynwyd, Pa.
THE ECONOMIC IMPACT OF NASA R AND D SPENDING Final Report
Michael K. Evans Apr. 1976 125 p refs
(Contract NASw-2741)
(NASA-CR-144352) Avail: NTIS HC $5.50 CSCL 05A

The economic impact of R and D spending, particularly NASA R and D spending, on the U. S. economy was evaluated. The crux of the methodology and hence the results revolve around the fact that it was necessary to consider both the demand effects of increased spending and the supply effects of a higher rate of technological growth and a larger total productive capacity. The demand effects are primarily short-run in nature, while the supply effects do not begin to have a significant effect on aggregate economic activity until the fifth year after increased expenditures have taken place. The short-term economic impact of alternative levels of NASA expenditures for 1975 was first examined. The long-term economic impact of increased levels of NASA R and D spending over a sustained period was then evaluated
Author

N76-24089*# Chase Econometric Associates, Inc., Bala Cynwyd, Pa.
THE ECONOMIC IMPACT OF NASA R AND D SPENDING Appendices
Michael K. Evans Apr. 1976 134 p refs
(Contract NASw-2741)
(NASA-CR-144353) Avail: NTIS HC $6.00 CSCL 05C

Seven appendices related to a previous report on the economic impact of NASA R and D spending were presented. They dealt with: (1) theoretical and empirical development of aggregate production functions, (2) the calculation of the time series for the rate of technological progress, (3) the calculation of the industry mix variable, (4) the estimation of distributed lags, (5) the estimation of the equations for gamma, (6) a ten-year forecast of the U.S. economy, (7) simulations of the macroeconomic model for increases in NASA R and D spending of $1.0, $.0.5, and 0.1 billions.
Y.J.A.

N76-24090*# Chase Econometric Associates, Inc., Bala Cynwyd, Pa.
THE ECONOMIC IMPACT OF NASA R AND D SPENDING: EXECUTIVE SUMMARY Final Report
Michael K. Evans Apr. 1976 23 p
(Contract NASw-2741)
(NASA-CR-144351) Avail: NTIS HC $3.50 CSCL 05C

An evaluation of the economic impact of NASA research and development programs is made. The methodology and the results revolve around the interrelationships existing between the demand and supply effects of increased research and development spending, in particular, NASA research and development spending. The INFORUM Inter-Industry Forecasing Model is used to measure the short-run economic impact of alternative levels of NASA expenditures for 1975. An aggregate production function approach is used to develop the data series necessary to measure the impact of NASA research and development spending, and other determinants of technological progress, on the rate of growth in productivity of the U. S. economy. The measured relationship between NASA research and development spending and technological progress is simulated in the Chase Macroeconometric Model to measure the immediate, intermediate, and long-run economic impact of increased NASA research and development spending over a sustained period. Author

N76-24091# Naval Ship Research and Development Center, Bethesda, Md.
PROCEEDINGS OF THE TECHNOLOGY TRANSFER SEMINAR/WORKSHOP ON THE APPLICATION OF POLLUTION ABATEMENT TECHNOLOGY TO LOCAL GOVERNMENTS Final Report
James W. Stinson May 1975 150 p refs Workshop held in Harrisburg, Pa., Jun. 1972
(AD-A018238; DTNSRDC-4672) Avail: NTIS CSCL 13/2

The following topics are presented. Keynote, Technology Transfer in the Navy Technical Session-- EPA Program for Abatement of Pollution from Boats, Sewage Treatment Devices on Great Lakes Carriers, The Coast Guard Shipboard Research and Development Program, The Naval Sea Systems Command Environmental Protection Program, Pollution Abatement Concerns on the State Level, Pollution Abatement Concerns of Anne Arundel County, Pollution Abatement Concerns at the City Level, and Techniques of Technology Transfer Workshop Programs-- Workshop A - Harbor Oil Spill Recovery, Workshop B - Test and Evaluation Procedures for Selecting Newly Developed Pollution Abatement Equipment, Workshop C - Pump- Out Waste Treatment Methods, Workshop D Solids Waste Disposal, Workshop E - Development of Environmentally Compatible Antifouling Materials Bottom Paints for Boats, and Workshop F- Environmental Measurement of Toxicity of Industrial Chemicals Using Chesapeake Bay Organisms. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-24092 Arizona Univ., Tucson.
STARLIGHT EXCITATION OF PERMITTED LINES IN GASEOUS NEBULAE Ph.D. Thesis
Steven Aldridge Grandi 1975 104 p
Avail: Univ. Microfilms Order No. 76-11329

Weak heavy element permitted lines observed in the spectra of gaseous nebulae were investigated. First, approximations and techniques of calculation were considered for the three possible excitation mechanisms: recombination and resonance fluorescence by the starlight continuum or by other nebular emission lines. Next, permitted lines of OI were studied. It was concluded that neither recombination nor resonance fluorescence by the Lyman lines can account for the strength of alpha 8446 and the presence of the other observed OI lines. However, resonance fluorescence by starlight can account for the strength of all the observed OI lines. Thirdly, it was shown that varying combinations of recombination and resonance fluorescence by starlight and other nebula lines can account for the observed strengths in the Orion Nebula of CII, NI, NII, NIII, OII, NeII, SiII, SiIII and SIII ions. A similar analysis was performed for the lines in the spectra of the planetary nebulae NGC7662 and NGC7027. Dissert. Abstr.

N76-24093 California Univ., Santa Cruz.
PRE-MAIN SEQUENCE MASSES AND THE AGE SPREAD IN THE ORION CLUSTER Ph.D. Thesis
Bernard Joseph McNamara 1975 123 p
Avail: Univ. Microfilms Order No. 76-9874

The spread in formation times for stars earlier than GO in the Orion cluster was investigated. The range of stellar ages in this cluster is found to extend from at least ten to the sixth years to about ten to the seventh years. On the basis of this evidence and the similarity of the color-magnitude diagrams of other young clusters to the Orion cluster, it is suggested that the current method of dating these clusters (from the point at which the most massive stars just reach the zero-age main sequence) might not be valid. The masses of forty-one pre-main sequence stars were determined from observed effective temperatures, luminosities, and gravities. These masses were then compared with those expected from Iben's (1965) pre-main sequence evolutionary calculations. In most cases, the agreement between these values was found to be within the observational errors. Pre-main sequence stars possessing infrared excesses are found to apparently be among the most massive and youngest stars still contracting toward the zero-age main sequence.
Dissert. Abstr.

N76-24094 California Univ., San Diego.
PULSAR MICROSTRUCTURE: TIME SCALES, SPECTRA, POLARIZATION, AND RADIATION MODELS Ph.D. Thesis
James Martin Cordes 1975 188 p
Avail: Univ. Microfilms Order No. 76-10110

Empirical and theoretical studies of pulsars were used to evaluate how the three regimes of temporal structure-average pulse profiles, subpulses, and micropulses-might be produced. Correlation and spectroscopic analyses of the emissions of several pulsars were conducted. Pulsar radiation was modeled statistically as polarized and amplitude modulated shot noise, and the conditions under which the moments of the intensity can reveal information about unresolved pulse structure were determined. Computations of the second moments of the Stokes parameters were shown to provide a means for measuring polarization fluctuations whose time scales are as short as the reciprocal receiver bandwidth. The production of subpulses and micropulses is discussed in terms of the distinction between angular beaming and temporal modulation. The similarity of subpulses and micropulses suggests that both are due to angular structure in the current, but the apparent independence of the average micropulse width with position in the pulse suggests that micropulses are due to temporal modulation of some kind.
Dissert. Abstr.

N76-24095 Northwestern Univ., Evanston, Ill.
THE WOLF-RAYET STARS OF M33 Ph.D. Thesis
George Joseph Corso, Jr. 1975 97 p
Avail: Univ. Microfilms Order No. 76-11879

Several Wolf-Rayet stars were classified into carbon and nitrogen sequences on the basis of photographic photometry of image tube plates. Carbon sequence Wolf-Rayet stars tend to be concentrated to the inner portions of M33 while the outer portions tend to be dominated by nitrogen sequence Wolf-Rayet stars. The distribution of these stars was compared with the distributions of luminous blue stars, dust, and H II regions. Carbon sequence Wolf-Rayet stars are much more likely to be found in associations than in nebulosity while nitrogen sequence stars are more often found in nebulosity than in associations. A larger proportion of the nitrogen sequence WR stars in M33 are associated with dust than carbon sequence. Star counts indicate

that one out of every 75 stars in M33 brighter than M sub B = -4.5 is a Wolf-Rayet star. In addition, the absolute magnitudes of almost all of the Wolf-Rayet stars which have been classified are consistent with the presence of a luminous O or B companion. Dissert. Abstr.

N76-24096*# Alaska Univ., Fairbanks. Geophysical Inst.
AIRBORNE OBSERVATIONS OF ASTRONOMICAL OBJECTS Final Report
G. G. Sivjee May 1976 43 p refs
(Grant NGR-02-001-106)
(NASA-CR-147233) Avail: NTIS HC $4.00 CSCL 03A

The UV spectra of the sun, as well as the differences and ratios of planetary and solar spectra, are presented. The results indicate that SO, SO2 and ClO2 may be present in Venus' atmosphere, and Formaldehyde CH2O and ClO2 on Jupiter. The solar UV measurements were analyzed to deduce ozone concentration in the earth's atmosphere. Author

N76-24097*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF THE VELA PULSAR: STATISTICS AND SPECTRUM
S. H. Pravdo, R. H. Becker, E. A. Boldt, S. S. Holt, R. E. Rothschild, P. J. Serlemitsos, and J. H. Swank May 1976 13 p refs Submitted for publication
(Grant NGR-21-002-316)
(NASA-TM-X-71113; X-611-76-98) Avail: NTIS HC $3.50 CSCL 03A

The Vela pulsar was observed in the range 2-60 keV by the GSFC proportional counter experiment onboard OSO-8 with temporal resolution sufficient to make possible a sensitive search for pulsed X-rays at the radio pulsar period. A statistical analysis yielded 8 per cent as the 3 sigma upper limit on the pulsed fraction. The energy spectrum is fit well by a structureless power law with number index 2.21 + or - 0.2 and absorption by a hydrogen column density of N sub H equals 2.9 + or - 2.0 times ten to the twenty-second power per sq.cm. Author

N76-24098*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR A 16d.6 PERIOD FROM CIRCINUS X-1
Louis J. Kaluzienski (Maryland Univ. College Park), S. S. Holt, E. A. Boldt, and P. J. Serlemitsos May 1976 14 p refs Submitted for publication
(NASA-TM-X-71114; X-661-76-96) Avail: NTIS HC $3.50 CSCL 03A

Analysis of All-Sky Monitor observations of Cir X-1 (3U-1516 -56) over the period October 1975 - April 1976 revealed a well-defined modulation of the 3-6 keV flux at a period of 16.585 + or - 0.01. The light-curve is characterized by an abrupt drop in emission occurring on a timescale of < 0.07, with epoch JD 2,442,877.181 + or - 0.07. No clear correspondingly sharp increase in emission is observed during the cycle, so that a noneclipse origin for this effect cannot be ruled out. Author

N76-24099# Owens Valley Radio Observatory, Pasadena, Calif.
THE UNUSUAL H2O MASER SOURCE NEAR HERBIG-HARO OBJECT NUMBER 11
K. Y. Lo, M. Morris, J. M. Moran, and A. D. Haschick 1975 19 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-A018458; Rept-1975-20) Avail: NTIS CSCL 03/2

H2O emission spectra of an unusual source near Herbig-Haro (HH) 11 have been monitored over a 14-month period. Variations of the intensity and the radial velocity of the emission are noticeable on time scales as short as one day. At any given time, only one or two velocity components are present in the spectrum. The variations are such that each component appears and disappears at a fixed radial velocity, and new components appear at seemingly random velocities within a 40 km/s range. It is suggested that the exciting source is losing mass via a stellar wind, and that the H2O emission arises in the transition region between the cavity created by the stellar wind and the surrounding molecular medium. The proposed model can be tested by VLBI observations; an accurate position for the H2O maser source is required to determine the physical relationship between the maser source and the IR or HH objects. Author (GRA)

N76-24100# Owens Valley Radio Observatory, Pasadena, Calif.
H2O MASER EMISSION ASSOCIATED WITH T TAURI AND OTHER REGIONS OF STAR FORMATION
G. R. Knapp and Mark Morris 1975 25 p refs
(Contract N00014-67-A-0094-0019)
(AD-A018361; Rept-1975-19) Avail: NTIS CSCL 03/2

The detection of H2O maser emission is reported from three new galactic regions: a point 0.9 min NE of T Tauri, and towards the HII regions G29.9-0.0 and G0.55-0.85. The T Tauri water source is not coincident with any known optical object; comparison of the H2O and CO observations of this region suggests the presence of an embedded protostellar region in the molecular cloud. These sources and those in S140-IR and Mon R2 were monitored for time variations and found that all sources except T Tauri are time-variable on the scale of a month. A model for the varying component of Mon R2 is proposed. GRA

N76-24101# Owens Valley Radio Observatory, Pasadena, Calif.
CO OBSERVATIONS OF NGC1579 (S222) AND S239
G. R. Knapp, T. B. H. Kuiper, S. L. Knapp, and Robert L. Brown 1975 36 p refs
(Contract N00014-67-A-0094-0019)
(AD-A018362; Rept-1975-18) Avail: NTIS CSCL 03/2

The 2.6-mm lines of 12CO and 13CO have been observed towards the small galactic diffuse nebulae NGC1579 (s222) and s239. The H92 alpha recombination line has also been detected from NGC1579. Towards NGC1579, we have observed evidence for self-absorption in the 12CO line. For both regions, high-velocity wings and line broadening are observable in the 12CO line; the features observed towards s239 suggest ordered, free-fall collapse of a localized region of the cloud onto a newborn stellar cluster. Examination of the available data suggests that NGC1579 is both a reflection nebula (illuminated by LkH alpha 101), and an obscured HII region excited by a star of spectral type near B1, while S239 is a reflection nebula or a Herbig-Haro object. Our studies of these regions show that line widening in CO is at least as important an indicator of star-formation activity as enhanced line emission. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-24102 Northwestern Univ., Evanston, Ill.
IMPROBABILITY OF COLLISIONS IN A NEWTONIAN GRAVITATIONAL SYSTEM OF SPECIFIED ANGULAR MOMENTUM Ph.D. Thesis
John Basil Urenko 1975 63 p
Avail: Univ. Microfilms Order No. 76-11929

The angular momentum integral of the equations of motion of the n-body problem of celestial mechanics defines a family of lower dimensional analytic manifolds in the phase space. It is shown that if n is greater than or equal to 3, then the intersection of the set of initial conditions which lead to collision with each manifold is of measure zero and of Baire first category in the manifold. Thus, when n is greater than or equal to 3 the collision initiating set satisfying an arbitrary value of angular momentum is small in both a measure theoretic and topological sense. It follows as a corollary that the converse of Sundman's Theorem of Total Collapse is not true when n is greater than or equal to 3. Dissert. Abstr.

N76-24103 Indiana Univ., Bloomington.
LINE FORMATION COOL STELLAR ATMOSPHERES Ph.D. Thesis
Walter L. Kelch 1975 115 p
Avail: Univ. Microfilms Order No. 76-11367

A series of investigations of spectral line formation in the atmospheres of cool giant stars has been made with three main emphases. In the general approach to calculation of the profiles and strengths for sodium in Arcturus, three model atmospheres

were used: (1) a model calculated from averaged or mean opacities, (2) a model calculated using the atomic and molecular opacities at each frequency point in the atmosphere rather than an average over a range of frequencies, and (3) an empirical model for Arcturus. Comparing theoretical curves of growth calculated under the conditions of a collisional population of the upper level (collision-dominated) to that of a photoionization populating mechanism of the upper level (photoionization-dominated), we find the photoionization-dominated lines to be generally weaker on the linear portion of the curve.
Dissert. Abstr.

N76-24104 Catholic Univ. of America, Washington, D.C.
OBSERVATIONS OF THE INTERPLANETARY MAGNETIC FIELD BETWEEN 0.46 AND 1 A.U. BY THE MARINER 10 SPACECRAFT Ph.D. Thesis
Kenneth Wayne Behannon 1976 234 p
Avail: Univ. Microfilms Order No. 76-11728

The interplanetary magnetic field was measured by the Magnetic Field Experiment onboard the Mariner 10 spacecraft from November 3, 1973 to April 14, 1974. A two-sector pattern of field polarity was observed during the last 3-1/2 months of the period, with the dominant polarity toward the sun below the solar equatorial plane. The dependence of the daily average radial and azimuthal components of the field on heliocentric distance, were determined 80 Relative fluctuations of the field magnitude and direction were found to have large time variations, another behaviour over the range of heliocentric distance was studied. The occurrence of directional discontinuities with increasing radial distance from the sun was also investigated. All types of fluctuations showed correlation with the high speed stream structure in the medium, with highest fluctuation levels associated with the high velocity regions of the streams.
Dissert. Abstr.

N76-24105 New York Univ., N.Y.
NEWTONIAN QUANTUM COSMOLOGY Ph.D. Thesis
Eugene Waluschka 1975 80 p
Avail: Univ. Microfilms Order No. 76-10237

The Newtonian universe is first treated as a gas which is homogeneous, isotropic and spatially infinite. The kinematics of this universe are such that every comoving observer sees an isotropic expansion. Gravitational potential can be uniquely found from Poisson's equation and classical equations of motion are invariant under transformations connecting local inertial frames. Using Newtonian mechanics the motions of this model universe are shown to agree with the motions of a gas as determined from a solution of Boltzmann's collisionless equation. The Newtonian universe is then treated as a matter field. The difficulties in quantizing the Newton universe are discussed. It is shown that the non-relativistic quantum equations of motion are invariant under transformations connecting local inertial frames. The unobservability of the uniform gravitational field is discussed when the laws of motion are non-relativistic quantum mechanics. A universe which can be regarded as a superfluid is constructed in which the motions are identical to the motions of the classical Newtonian universe. Dissert. Abstr.

N76-24106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL DEVELOPMENT EPHEMERIS NUMBER 96
E. Myles Standish, Jr., Michael S. W. Keesey, and X. X. Newhall 29 Feb. 1976 42 p refs
(Contract NAS7-100)
(NASA-CR-147923; JPL-TR-32-1603) Avail: NTIS HC $4.00 CSCL 03B

The fourth issue of JPL Planetary Ephemerides, designated JPL Development Ephemeris No. 96 (DE96), is described. This ephemeris replaces a previous issue which has become obsolete since its release in 1969. Improvements in this issue include more recent and more accurate observational data, new types of data, better processing of the data, and refined equations of motion which more accurately describe the actual physics of the solar system. The descriptions in this report include these new features as well as the new export version of the ephemeris. The tapes and requisite software will be distributed through the NASA Computer Software Management and Information Center (COSMIC) at the University of Georgia. Author

N76-24107*# Kanner (Leo) Associates, Redwood City, Calif.
FORMATION OF PANCAKE FROM DUST MATTER MOVING WITHOUT ROTATION
I. D. Novikov Washington NASA May 1976 10 p refs Transl. into ENGLISH from Akad. Nauk SSR Inst. Kosmich. Issled. (Moscow), no. Pr-229, 1975 p 1-9
(Contract NASw-2790)
(NASA-TT-F-17031; Pr-229) Avail: NTIS HC $3.50 CSCL 03B

A theorem is proven regarding the necessary development of two-dimensional formations with an infinite density, but with finite surface density (pancakes) in a medium with negligible pressure in the absence of eddy motion. The conditions leading to the development of pancakes are created in a hot expanding universe after hydrogen recombination. The pancakes formed are galactic protoclusters. Author

N76-24108*# California Inst. of Tech., Pasadena. W. K. Kellogg Radiation Lab.
THE RELATIVISTIC EQUATIONS OF STELLAR STRUCTURE AND EVOLUTION
Kip S. Thorne [1975] 20 p refs
(Grants NGR-05-002-256; NSF AST-75-01398-A01)
(NASA-CR-147950) Avail: NTIS HC $3.50 CSCL 03B

The general relativistic equations of stellar structure and evolution are reformulated in a notation which makes easy contact with Newtonian theory. A general relativistic version of the mixing-length formalism for convection is presented. It is argued that in work on spherical systems, general relativity theorists have identified the wrong quantity as total mass-energy inside radius r. Author

N76-24109*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN X-RAY RED-SHIFT TEST FOR CLUSTERS OF GALAXIES UP TO Z GREATER THAN OR EQUAL TO 1
Elihu Boldt Apr. 1976 7 p refs Submitted for publication
(NASA-TM-X-71102) Avail: NTIS HC $3.50 CSCL 03B

Correlated measurements of red-shifted iron line emission and apparent surface brightness are suggested for unambiguously defining intrinsic X-ray characteristics for clusters of galaxies up to z greater than or equal to 1. If some of the weak unidentified high galactic latitude X-ray sources are clusters at z approximately 1-3, then such correlated measurements should be feasible witin the complement of instruments aboard the HEAO-B orbiting X-ray telescope observatory. In addition, those clusters at z less than 1 would require spectral data from broader bandwidth experiments, such as the all-sky survey to be provided by the proportional counters aboard the first mission of the High Energy Astronomy Observatory (HEAO-A). Author

N76-24134* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INVESTIGATION OF INTERPLANETARY DUST FROM OUT-OF-ECLIPTIC SPACE PROBES
Hugo Fechtig (Max-Planck-Inst. fuer Kernphysik), R. H. Giese (Ruhr-Univ.), Martha S. Hanner (State Univ. of N. Y., Albany), and Herbert A. Zook *In its* Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 298-320 refs (For availability see N76-24119 14-92)
CSCL 03B

N76-24135* Arizona Univ., Tucson. Dept. of Physics.
A MEANS OF IN-SITU MEASUREMENTS OF NEUTRAL H AND He ON AN OUT-OF-THE-ECLIPTIC MISSION
K. C. Hsieh *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 321-329 refs (For availability see N76-24119 14-92)
(Grant NGR-03-002-107)
CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-24110* National Aeronautics and Space Administration, Washington, D.C.
DISCOVERIES ABOUT JUPITER. RESULTS FOR PIONEERS 10 AND 11 COMBINED WITH EARTH-BASED FINDINGS
17 May 1976 61 p
(NASA-News-Release-76-91) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

Included in this discussion of findings regarding the planet Jupiter are atmospheric characteristics, weather, the magnetosphere, radiation belts, radio emission, natural satellites, possible origins, the Great Red Spot, the interior and the possibility of life. D.M.L.

N76-24111 Syracuse Univ., N.Y.
A PARAMETRIC MODEL FOR THE SATURN RADIATION FIELD Ph.D. Thesis
George William Francis 1974 90 p
Avail: Univ. Microfilms Order No. 76-7645

The angular momentum of a magnetized rotating ring system is shown to be responsible for the lack of significant synchroton radiation even though the large magnetic field is 11.3 gauss. A corrollary indicates that large ring rotational energy is a manifestation of little non-thermal radiation. This observation is virtually independent of the magnitude of the magnetic field. The model generates an electric field capable of accelerating electrons and protons to relativistic energies and ejecting them from the ring plane. The electric field is necessary to create a magnetosphere coupled to the magnetic field. This leads to non-thermal radiation and ring momentum loss. This mechanism is considered part of a dynamic exchange with the conductive dust particles and charged particles of the Saturn environment. That is, the rings are a visible link with the magnetosphere and satellite system. Spatial quantization is proposed as a mechanism for the evolution of the single but true ring separation called the Cassini Division. Dissert. Abstr.

N76-24112*# California Univ., Berkeley. Dept. of Physics.
HETERODYNE DETECTION OF CO2 EMISSION LINES AND WIND VELOCITIES IN THE ATMOSPHERE OF VENUS
A. L. Betz, M. A. Johnson, R. A. McLaren, and E. C. Sutton [1975] 30 p refs
(Grants NGR-05-003-452; NGL-05-003-272; NSF AST-75-20353)
(NASA-CR-147231) Avail: NTIS HC $4.00 CSCL 03B

Strong 10 micrometer line emission from (C-12)(O-16)2 in the upper atmosphere of Venus was detected by heterodyne techniques. Observations of the absolute Doppler shift of the emission features indicate mean zonal wind velocities less than 10 m/sec in the upper atmosphere near the equator. No evidence was found of the 100 m/sec wind velocity implied by the apparent 4-day rotation period of ultraviolet cloud features. Author

N76-24113*# Kanner (Leo) Associates, Redwood City, Calif.
INFRARED RADIOMETRY AND PHOTOMETRY FROM VENERA-9 AND VERERA-10 DATA
L. V. Ksanfomaliti Washington NASA May 1976 11 p refs Transl. into ENGLISH from Pisma v Astron. Zh. (USSR), v. 2, no. 2, Feb. 1976 p 75-81
(Contract NASw-2790)
(NASA-TT-F-17022) Avail: NTIS HC $3.50 CSCL 03B

The Venera-9 and -10 radiometers, third generations instruments of the first ones on Mars-3 and -5, with angular resolution 0.02 radian and threshold sensitivity 65 K, operate in the 8-13 micron and 18-28 micron infrared emitted by the Venus upper cloud layers. The 3,500 A ultraviolet brightness of the same portion of cloud layer also is measured by a photometer with a 100 A bandwidth and angular resolution 0.004 radian. The infrared and ultraviolet brightness and brightness temperature distributions obtained by Venera-9 and -10 are given in separate figures. An average brightness temperature of 235 + or - 1 K and a more accurate Venus radiometric albedo, 0.787 + or - 0.017, were obtained from these distributions. The energy distribution curves from 3,300 to 8,000 A in the Venus spectrum for various points of the satellite track also are presented. They were obtained by photometer-polarimeters operating in nine spectral ranges. The possible cause of discrepancy between this brightness temperature and the value of 255 K obtained from Mariner-10 data is discussed. Author

N76-24114*# Kanner (Leo) Associates, Redwood City, Calif.
SOME CONCLUSIONS CONCERNING THE STRUCTURE OF THE SURFACE LAYER OF THE VENUS ATMOSPHERE
V. I. Moroz Washington NASA May 1976 7 p ref Transl. into ENGLISH from Pisma v Astron. Zh. (USSR), v. 2, no. 2, Feb. 1976 p 72-74
(Contract NASw-2790)
(NASA-TT-F-17018) Avail: NTIS HC $3.50 CSCL 03B

Preliminary analysis of published panoramic images of Venus is used to derive some conclusions concerning the properties of the Venus atmosphere near the ground surface. Expressions are used for a distance to the visible horizon, normal and anamalous refractions, the curvature radius of a light beam, the angle between the vertical and the direction to the visible horizon, and a temperature gradient near the surface to derive the relationship between the distance to the horizon and the temperature difference in the surface layer of an atmosphere one meter thick. This relationship is presented graphically, together with the horizon elevation (caused by refraction) as a function of the same temperature difference. It is concluded from the Venus surface pictures and these curves that the temperature in the surface layer of a Venus atmosphere 1 meter thick decreases with elevation by an amount on the order of 0.1 - 1 K. Author

N76-24115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFLUENCE OF PLANETARY-SCALE TOPOGRAPHY ON THE DIURNAL THERMAL TIDE DURING THE 1971 MARTIAN DUST STORM
Barney J. Conrath Jan. 1976 42 p refs Submitted for publication
(NASA-TM-X-71111; X-622-76-75) Avail: NTIS HC $4.00 CSCL 03B

Data obtained with the Mariner 9 infrared spectroscopy experiment during the Martian Dust Storm of 1971 to 1972 are examined for evidence of topographic influence on the atmospheric thermal structure. Temperature perturbations which are well correlated with the planetary scale topography are found superposed on the large amplitude diurnal thermal tide. Applications of tidal theory to the data indicate that the observed perturbations result from the kinematic interaction of the westward traveling diurnal wave with the large scale components of topography. The dominant mode is excited by the wave-number two topography component and is a vertically evanescent eastward traveling wave with an equivalent depth comparable to the atmospheric scale height. The principle dynamic effect of this mode is the enhancement of the amplitude of the near-surface diurnal wind to over 40m/sec in limited areas near 30 deg south latitude. It appears likely that dust was injected into the atmosphere in these regions during the storm. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-24116 Indiana Univ., Bloomington.
A STUDY OF ULTRAVIOLET EXTINCTION IN THE SOLAR ATMOSPHERE Ph.D. Thesis
John Nash Dragon 1975 236 p
Avail: Univ. Microfilms Order No. 76-11414

An effort was made to reproduce the observed solar continuum, central intensity, and Eddington flux by treating important bound-free absorbers, diatomic molecular bands, and

atomic lines. Emphasis was placed on the 0.5 to 0.15 micron ultraviolet region. Predictions were made with the stellar atmosphere computer program ATLAS5 modified to incorporate the new absorption sources. Two empirical solar atmospheric structures were employed. Bound-free absorption was augmented through quantum-defect and hydrogenic excited term cross-sections for neutral C, Mg, Al and Si, a measured ground state All cross-section, and twenty-six theoretical neutral Fe term cross sections. Localized regions of strong ultraviolet absorption were found to be due to CH, NH, OH, CN and SiO. Dissert. Abstr.

N76-24117*# Stanford Univ., Calif. Inst. for Plasma Research.

ON THE REALITY OF A SUN-WEATHER EFFECT

John M. Wilcox, Leif Svalgaard, and Philip H. Scherrer Oct. 1975 15 p refs Submitted for publication

(Contract N00014-76-C-0207; Grants NGR-05-020-559; NSF DES-74-19007; NSF DES-75-15664)

(NASA-CR-147228; SU-IPR-645) Avail: NTIS HC $3.50 CSCL 03B

An influence of the solar magnetic sector structure on the terrestrial atmospheric vorticity has been reported. The reported effect persists when the number of sector boundary passages examined is increased from 54 to 131. The same effect is found independently in the latitude zones 35 N - 55 N and greater than 55 N. The depth of the sector-related effect is much greater than the depth of any other minimum in an extended analysis. These results support the reality of the effect. Author

N76-24118*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Inst. for Plasma Research.

RELATION OF THE OBSERVED FAR ULTRAVIOLET SOLAR IRRADIANCE TO THE SOLAR MAGNETIC SECTOR STRUCTURE

Donald F. Heath, John M. Wilcox, Leif Svalgaard, and Thomas L. Duvall Jul. 1975 11 p refs Prepared in cooperation with Stanford Univ., Calif.

(Grants NGR-05-020-559; NsG 5024; Contract N00014-67-A-0112-0068; Grant NSF DES-74-19007)

(NASA-TM-X-73070; SU-IAR-638) Avail: NTIS HC $3.50 CSCL 03B

Comparison of the observed solar far ultraviolet irradiance and the observed solar sector structure during 1969 through 1972 shows a tendency for EUV maxima to be located near sector boundaries. Author

N76-24119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCEEDINGS OF THE SYMPOSIUM ON THE STUDY OF THE SUN AND INTERPLANETARY MEDIUM IN THREE DIMENSIONS

L. A. Fisk, ed. and W. I. Axford, ed. (Max-Planck Inst. for Aeronomy) Mar. 1976 345 p refs Proc. held at Greenbelt, Md., 15-16 May 1975; sponsored in part by ESA

(NASA-TM-X-71097; X-660-76-53) Avail: NTIS HC $10.00 CSCL 03B

A series of papers are presented from a symposium attended by over 200 European and American scientists to examine the importance of exploring the interplanetary medium and the sun by out-of-the-ecliptic space missions. The likely scientific returns of these missions in the areas of solar, interplanetary, and cosmic ray physics is examined. Theoretical models of the solar wind and its interaction with interplanetary magnetic fields are given. For individual titles, see N76-24120 through N76-24135.

N76-24120* Chicago Univ., Ill. Enrico Fermi Inst. and Dept. of Physics.

EXPERIMENTS OUT OF THE SOLAR SYSTEM ECLIPTIC PLANE: AN INTRODUCTION TO THE ECLIPTIC MISSION

J. A. Simpson *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 10-36 refs (For availability see N76-24119 14-92)

(Grant NGL-14-001-006)

CSCL 03B

Mission planning by NASA and ESA for the 1980 timeframe to observe the sun from an angle other than the solar ecliptic plane is discussed. Such missions will aid in a more thorough understanding of the sun, interplanetary space, and their influence on the earth. Jupiter swing-by techniques (first achieved by Pioneer 10) are proposed as a means of achieving an out-of-the-ecliptic mission for solar studies. Spacecraft trajectories are illustrated for a dual Pioneer spacecraft mission to observe the sun. J.R.T.

N76-24121* Harvard Coll. Observatory, Cambridge, Mass. Center for Astrophysics.

AN ALTERNATIVE OPTION TO THE DUAL-PROBE OUT-OF-ECLIPTIC MISSION VIA JUPITER SWINGBY c13

G. Colombo, D. A. Lautman, and G. Pettengill (MIT) *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 37-47 refs (For availability see N76-24119 14-92)

CSCL 22A

The possibility of having a high-inclination out-of-the-ecliptic probe complemented by a second probe going from Jupiter to the sun along a rectilinear path (at least for the segment from 0.3 a.u. inward to the sun) is theoretically examined. Orbit calculations of spacecraft trajectories are included. Author

N76-24122* Harvard Coll. Observatory, Cambridge, Mass. Center for Astrophysics.

OUT-OF-ECLIPTIC STUDIES OF CORONAL HOLES AND THEIR RELATION TO THE SOLAR WIND

R. W. Noyes *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 48-58 refs (For availability see N76-24119 14-92)

CSCL 03B

The advantages of observing coronal holes of the sun above the solar ecliptic plane by a solar probe are discussed. Also discussed are the size of coronal holes, their temperature, and magnetic fields associated with the holes. The role of coronal holes in contributing to the solar wind is examined. Data and observations on coronal holes from Skylab and OSO are treated. It is concluded that an out-of-the-ecliptic solar probe mission would greatly add to the understanding of coronal holes (at high latitudes) thus adding a new perspective to the observation of these phenomena. (Photographs of the sun taken by Skylab are shown). J.R.T.

N76-24123* National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.

SOLAR MAGNETIC FIELDS AND THE CORONA

Gordon Newkirk, Jr. *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 59-64 Sponsored by NSF (For availability see N76-24119 14-92)

CSCL 03B

Results from a seminar on the role of solar magnetic fields in determining the structure of the corona and interplanetary medium are presented. Some topics considered are: (1) polar regions of the sun which have identical magnetic configurations but display a vastly different appearance in the corona, (2) the influence of latitude on coronal and interplanetary microstructure, and (3) the role of the corona in contributing to the solar wind. It is proposed that an out-of-the-ecliptic solar probe mission would provide needed information on the above topics, and the study of solar activity in general. J.R.T.

N76-24124* Observatoire de Paris-Meudon (France).

THE 3-D SOLAR RADIOASTRONOMY AND THE STRUCTURE OF THE CORONA AND THE SOLAR WIND

J. L. Steinberg and C. Caroubalos *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 65-83 refs Sponsored by CNES (For availability see N76-24119 14-92)

CSCL 03B

The mechanism causing solar radio bursts (1 and 111) is examined. It is proposed that a nonthermal energy source is responsible for the bursts; nonthermal energy is converted into electromagnetic energy. The advantages are examined for an out-of-the-ecliptic solar probe mission, which is proposed as a

means of stereoscopically viewing solar radio bursts, solar magnetic fields, coronal structure, and the solar wind. J.R.T.

N76-24125* California Univ., La Jolla.
IPS OBSERVATIONS OF THE SOLAR WIND SPEED OUT OF THE ECLIPTIC
William A. Coles and Barney J. Rickett *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 84-94 refs (For availability see N76-24119 14-92)
(Grant NSF DES-75-13451)
CSCL 03B

Interplanetary scintillation observations from 1971-1975 show that the average solar wind speed increases away from the solar equator, with a mean gradient of 2.1 km/s per degree. These results are compared with spacecraft observations over the + or - 7 deg attainable in the ecliptic and with those deduced from comet tails. The role of temporal variations, especially those caused by latitude dependent solar wind streams, is emphasized, and this points to the need for extensive ecliptic and ground-based observations during an out-of-the-ecliptic spacecraft mission. Author

N76-24126* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATITUDINAL PROPERTIES OF THE SOLAR WIND FROM STUDIES OF IONIC COMET TAILS
John C. Brandt *In its* Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 95-107 refs (For availability see N76-24119 14-92)
CSCL 03B

A statistical analysis is presented of the orientations of ionic comet tails in the solar wind. The analysis indicates that the radial solar wind speed is not necessarily higher near the solar poles than near the equator. The results refer to a long-term, global flow pattern and do not refer to short-term variations of solar wind speed. Author

N76-24127* Los Alamos Scientific Lab., N.Mex.
IMPLICATIONS OF SAITO'S CORONAL DENSITY MODEL ON THE POLAR SOLAR WIND FLOW AND HEAVY ION ABUNDANCES
William C. Feldman *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 108-142 refs Sponsored by ERDA (For availability see N76-24119 14-92)
CSCL 03B

A comparison of polar solar wind proton flux upper limits derived using a coronal density model, with Lyman alpha measurements of the length of the neutral H tail of comet Bennet at high latitudes, shows that either extended heating beyond 2 solar radii is necessary some of the time or that the model's polar densities are too low. Whichever possibility is the case, the fact that the solar wind particle flux does not appear to decrease with increasing latitude indicates that the heavy element content of the high latitude wind may be similar to that observed in the ecliptic. It was then shown that solar wind heavy ion observations at high latitudes allow a determination of the electron temperature at heights which bracket the nominal location of the coronal temperature maximum thus providing information concerning the magnitude and extent of mechanical dissipation in the intermediate corona. Author

N76-24128* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LARGE-SCALE MAGNETIC FIELD IN THE SOLAR WIND
L. F. Burlaga and N. F. Ness *In its* Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 143-165 refs (For availability see N76-24119 14-92)
CSCL 03B

A literature review is presented of theoretical models of the interaction of the solar wind and interplanetary magnetic fields. Observations of interplanetary magnetic fields by the IMP and OSO spacecraft are discussed. The causes for cosmic ray variations (Forbush decreases) by the solar wind are examined. The model of Parker is emphasized. This model shows the three dimensional magnetic field lines of the solar wind to have the form of spirals wrapped on cones. It is concluded that an out-of-the-ecliptic solar probe mission would allow the testing and verification of the various theoretical models examined. Diagrams of the various models are shown. J.R.T.

N76-24129* California Univ., Los Angeles. Dept. of Meteorology.
THREE DIMENSIONAL ASPECTS OF INTERPLANETARY SHOCK WAVES
George L. Siscoe *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 166-187 refs (For availability see N76-24119 14-92)
(Grants NGL-22-009-015; NGL-22-009-372; NSF GA-13842)
CSCL 03B

Most of the interplanetary shock waves observed with 1 AU of the sun originate from some short lived solar event, such as a solar flare, and then propagate out as a more-or-less spherical shock wave until they leave the solar system. Beyond 1 AU another class of interplanetary shock wave becomes common--the corotating shock pair formed by the interaction of long lived solar wind streams. The three dimensional geometry of these two classes of interplanetary shocks is discussed. Also discussed are how these geometries can be statistically studied with an out-of-the-ecliptic mission. Diagrams of shock wave propagation are shown. Also given are numerical examples of shock wave propagation. Author

N76-24130* Arizona Univ., Tucson. Dept. of Planetary Sciences.
COSMIC-RAY TRANSPORT THEORY AND OUT-OF-THE-ECLIPTIC EXPLORATION **c93**
J. R. Jokipii *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 188-209 refs (For availability see N76-24119 14-92)
(Grant NsG-7101)
CSCL 03B

The reasons for studying cosmic-ray transport theory are summarized and the fundamentally three-dimensional nature of the process is pointed out. It is shown that observations in the solar ecliptic plane cannot unambiguously test transport theories since the solutions to the transport equations depend critically on boundary conditions and variation of parameters such as diffusion tensor out of the ecliptic. Sample calculations (Fokker-Planck coefficient) are shown which illustrate the problem. It is concluded that out-of-the-ecliptic observations are essential to further test transport theory. Author

N76-24131* Imperial Coll. of Science and Technology, London (England).
COSMIC RAY MODULATION IN THREE DIMENSIONS **c93**
J. J. Quenby *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 210-230 refs (For availability see N76-24119 14-92)
CSCL 03B

A brief critique of spherically symmetric conventional modulation theory is supplied. Estimates are made of the cosmic ray intensity at high solar latitudes. Direct evidence for significant off-ecliptic cosmic ray gradients is reviewed in support of the requirement for an off-ecliptic spacecraft mission. The possibility of measuring the galactic spectrum is discussed. The effect of interplanetary magnetic fields on cosmic ray motion is examined, and calculations (Fokker-Planck equation) are shown. Author

N76-24132* California Univ., Berkeley. Physics Dept. and Space Sciences Lab.
SOLAR COSMIC RAY MEASUREMENTS AT HIGH HELIOCENTRIC LATITUDES
Kinsey A. Anderson *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 231-260 refs (For availability see N76-24119 14-92)
(Grant NGR-05-003-017)
CSCL 03B

A brief review is presented of what might result from a program of solar cosmic ray observations on 'out-of-the-ecliptic' spacecraft. The following topics are discussed: (1) The magnetic fields of the sun at high latitudes, (2) propagation of fast charged particles in the solar corona and in interplanetary space at high latitudes, (3) origin of interplanetary particle populations and the solar wind, (4) other particle phenomena in interplanetary space (e.g., acceleration of shock waves), and (5) effect of spacecraft mission characteristics on solar cosmic ray studies at high latitudes. Maps of polar coronal magnetic fields are shown. Author

N76-24133* Kiel Univ. (West Germany).
CORONAL PROPAGATION: VARIATIONS WITH SOLAR LONGITUDE AND LATITUDE
G. Wibberenz *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 261-299 refs (For availability see N76-24119 14-92)
CSCL 03B

Observational results on the East-West effect are summarized and discussed in the context of existing models of coronal propagation. The variation of the number of events with solar longitude is shown to be surprisingly similar for particles covering a large interval of rigidities. Also, over large longitudinal distances, time delays to the event onset and maximum intensity are independent of energy and velocity. This has important implications and will require probably a transport process which is determined by fundamental properties of solar magnetic fields, e.g. reconnection processes between open and closed field configurations. The relative role of open and closed field configurations is extensively discussed. Some evidence is presented that the acceleration of protons to higher (approximately 10 MeV) energies is related with a shock wave traveling in the solar atmosphere. The importance of measurements performed from spacecraft out-of-the-ecliptic plane is stressed. Author

N76-24134* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INVESTIGATION OF INTERPLANETARY DUST FROM OUT-OF-ECLIPTIC SPACE PROBES **c90**
Hugo Fechtig (Max-Planck-Inst. fuer Kernphysik), R. H. Giese (Ruhr-Univ.), Martha S. Hanner (State Univ. of N. Y., Albany), and Herbert A. Zook *In its* Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 298-320 refs (For availability see N76-24119 14-92)
CSCL 03B

Measurements of interplanetary dust via zodiacal light observations and direct detection are discussed for an out-of-ecliptic space probe. Particle fluxes and zodiacal light brightnesses were predicted for three models of the dust distribution. These models predict that most of the information will be obtained at space probe distances less than 1 A.U. from the ecliptic plane. Joint interpretation of the direct particle measurements and the zodiacal light data can yield the best knowledge of the three-dimensional particle dynamics, spatial distribution, and physical characteristics of the interplanetary dust. Such measurements are important for an understanding of the origin and role of the dust in relation to meteoroids, asteroids, and comets, as well as the interaction of the dust with solar forces. Author

N76-24135* Arizona Univ., Tucson. Dept. of Physics.
A MEANS OF IN-SITU MEASUREMENTS OF NEUTRAL H AND He ON AN OUT-OF-THE-ECLIPTIC MISSION **c90**
K. C. Hsieh *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 321-329 refs (For availability see N76-24119 14-92)
(Grant NGR-03-002-107)
CSCL 03B

On an out-of-the-ecliptic mission, in situ measurements of densities and temperature of interstellar neutral H and He in the heliosphere should complement observations based on backscattered Lyman-alpha intensities. A means of performing the in situ measurements is briefly described. Author

N76-24136*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC HOLES IN THE SOLAR WIND
J. M. Turner (Morehouse College), L. F. Burlaga, N. F. Ness, and J. F. Lemaire May 1976 20 p refs Submitted for publication
(NASA-TM-X-71109; X-692-76-90) Avail: NTIS HC $3.50 CSCL 03B

An analysis is presented of high resolution interplanetary magnetic field measurements from the magnetometer on Explorer 43 which showed that low magnetic field intensities in the solar wind at 1 AU occur as distinct depressions or 'holes'. These magnetic holes are new kinetic-scale phenomena, having a characteristic dimension on the order of 20,000 km. They occurred at a rate of 1.5/day in the 18-day time span (March 18 to April 6, 1971) that was analyzed. Most of the magnetic holes are characterized by both a depression in the absolute value of the magnetic field, and a change in the magnetic field direction; some of these are possibly the result of magnetic merging. However, in other cases the magnetic field direction does not change; such holes are not due to magnetic merging, but might be a diamagnetic effect due to localized plasma inhomogeneities. Author

N76-24137# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
RESULTS OBTAINED DURING THE CAMPAIGN FOR INTEGRATED OBSERVATIONS OF SOLAR FLARES (CINOF)
M. A. Shea, ed. and D. F. Smart, ed. 13 Aug. 1975 139 p refs
(AF Proj. 8600)
(AD-A018336; AFCRL-TR-75-0437; AFCRL-SR-193) Avail: NTIS CSCL 03/2

The Campaign for Integrated Observations of Solar Flares (CINOF) was a period of extensive solar flare studies conducted 5-29 June 1972. Specific scientists were designated as CINOF coordinators to study selected events. This compilation contains seven reports: Five reports detailing solar phenomena associated with CINOF selected flares, one report detailing observations of a flare initiated shock wave propagating through the interplanetary medium, and one report on the solar particle and associated interplanetary measurements during this period. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-24138 Ohio State Univ., Columbus.
BRIGHTNESS AND LINEAR POLARIZATION DISTRIBUTIONS OBTAINED FROM RADIO INTERFEROMETY Ph.D. Thesis
Philip Franklin Honsberger 1975 291 p
Avail: Univ. Microfilms Order No. 76-9980

Information about the physical processes operating within a cosmic radio source may be deduced from the distributions over the source extent of the total power and linear polarization intensities. Brightness (total power) and linear polarization distributions of selected radio sources were studied employing the methodology of tensor aperture synthesis. Visibility functions for the total power and linear polarization are measured with a radio interferometer. After a visibility function has been sampled at a sufficient number of points in the spatial frequency (u-v) plane, a Fourier inversion is performed to produce the desired distribution. Using the coherency matrix formalism to describe the interaction of the incident radiation (which is assumed to be a quasi-monochromatic, partially polarized wave) with the receiving antennas, an expression is developed that gives the interferometer response for an extended source. By using left-handed and right-handed circularly polarized feeds, four polarization coherence functions can be determined.
Dissert. Abstr.

N76-24139 New Hampshire Univ., Durham.
NEUTRON MEASUREMENTS AT BALLOON ALTITUDES USING ORGANIC SCINTILLATORS AND APPLICATION FOR GAMMA RAY MEASUREMENTS Ph.D. Thesis
Chia Yu Chen 1975 52 p
Avail: Univ. Microfilms Order No. 76-11678

The neutron differential energy spectrum at altitudes from 4.2g/sq cm to 2.9g/sq cm was measured by two liquid organic cylindrical scintillators during a balloon flight at Palestine, Texas, on June 22, 1973. These detectors were calibrated at the University of New Hampshire Van der Graaff accelerator and at the Michigan State University cyclotron. Experimental response functions from calibrations were used to unfold the observed neutron spectrum. The neutron leakage current spectrum measured in this flight normalized to sunspot minimum is given. A computer program using the Monte Carlo technique to unfold the measured gamma ray spectrum was developed and applied to the gamma ray data obtained. A prototype neutron-gamma ray telescope system was also included which incorporated a time of flight system between the two detectors and used the double scattering technique to measure the directional fluxes and energy spectra of neutrons and gamma rays. Dissert. Abstr.

N76-24140# Commissariat a l'Energie Atomique, Saclay (France).
INVERSE COMPTON PRODUCTION OF GAMMA RAYS IN INTERSTELLAR SPACE
P. G. Shukla, M. Casse, C. J. Cesarsky, and J. Paul 1975 5 p refs Presented at the 14th Internl. Cosmic Ray Conf., Munich, 15-29 Aug. 1975
(CEA-Conf-3078; Conf-750805-20) Avail: ERDA Depository Libraries HC $4.00

The longitude distribution of gamma rays of energy > MeV produced by the inverse Compton interaction in the galaxy is calculated. Cosmic ray electron density is considered either uniform throughout the galactic plane, or varying in accordance with the model of Paul et al. (1974). Stellar photon intensity is estimated using models of mass distribution in the galactic nucleus and the disc. Contribution of the 2.7 K black-body radiation is included. It is found that the calculated gamma ray flux from the galactic center direction is lower than that measured by the SAS II satellite by an order of magnitude. Author (ERA)

N76-24141# Radiation Research Associates, Inc., Fort Worth, Tex.
A USERS MANUAL FOR THE AFWL SPACE RADIATION ENVIRONMENT AND SHIELDING CODES Final Report, 30 Sep. 1973 - 31 Jul. 1974
Keith C. Hopkins Aug. 1975 97 p refs
(Contract F33657-72-C-0169; DNA Proj. NWED-QAXHC047) (AD-A019042; RRA-T7408; AFWL-TR-74-292) Avail: NTIS CSCL 18/6

The Air Force Weapons Laboratory (AFWL) Space Radiation Environment and Shielding Codes (SPARES) that are used to calculate the natural space radiation environment have been intensively modified. The SPARES codes use a satellite's shielding distribution in conjunction with radiation transport calculations to obtain flux-to-dose conversion factors. These factors are then used in conjunction with trajectory and environment data to obtain the dose and dose rate in rad units at specified locations within the satellite over any time period. The dose conversion factors computed by the SPARES codes have been modified to be compatible with other AFWL codes. The latest models of the natural proton and electron space radiation environments have been incorporated. A thorough internal code documentation has been performed using comment cards. All machine language has been replaced with American National Standards Institute (ANSI) FORTRAN, and with the exception of data statements, all coding has been converted to ANSI FORTRAN. A detailed user's manual has been prepared. GRA

N76-24130* Arizona Univ., Tucson. Dept. of Planetary Sciences.
COSMIC-RAY TRANSPORT THEORY AND OUT-OF-THE-ECLIPTIC EXPLORATION
J. R. Jokipii *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 188-209 refs (For availability see N76-24119 14-92)
(Grant NsG-7101)
CSCL 03B

N76-24131* Imperial Coll. of Science and Technology, London (England).
COSMIC RAY MODULATION IN THREE DIMENSIONS
J. J. Quenby *In* NASA. Goddard Space Flight Center Proc. of the Symp. on the Study of the Sun and Interplanetary Medium in Three Dimensions Mar. 1976 p 210-230 refs (For availability see N76-24119 14-92)
CSCL 03B

99 GENERAL

N76-24142*# National Aeronautics and Space Administration, Washington, D.C.
NASA HISTORICAL DATA BOOK, 1958-1968. VOLUME 1: NASA RESOURCES
Jane VanNimmen, Leonard C. Bruno, and Robert L. Rosholt 1976 547 p refs
(NASA-SP-4012; LC-74-600126) Avail: NTIS HC $12.50 CSCL 05A

This is the first volume of a series meant to provide a comprehensive statistical summary of the first decade of the National Aeronautics and Space Administration, from its post-Sputnik creation until the Apollo 8 astronauts became the first men to circle the moon. Volume I is designed as a reference source for a variety of purposes. In many ways it offers time-oriented data comparable to a chronology, but from a quantitative perspective. The statistical summary of NASA's first 10 years documents, in a nuts-and-bolts fashion, the immense growth and eventual leveling off of the agency's program. It covers NASA's budget and financial history, its scattered installations, its manpower resources, and a statistical summary of its contractual history. Author